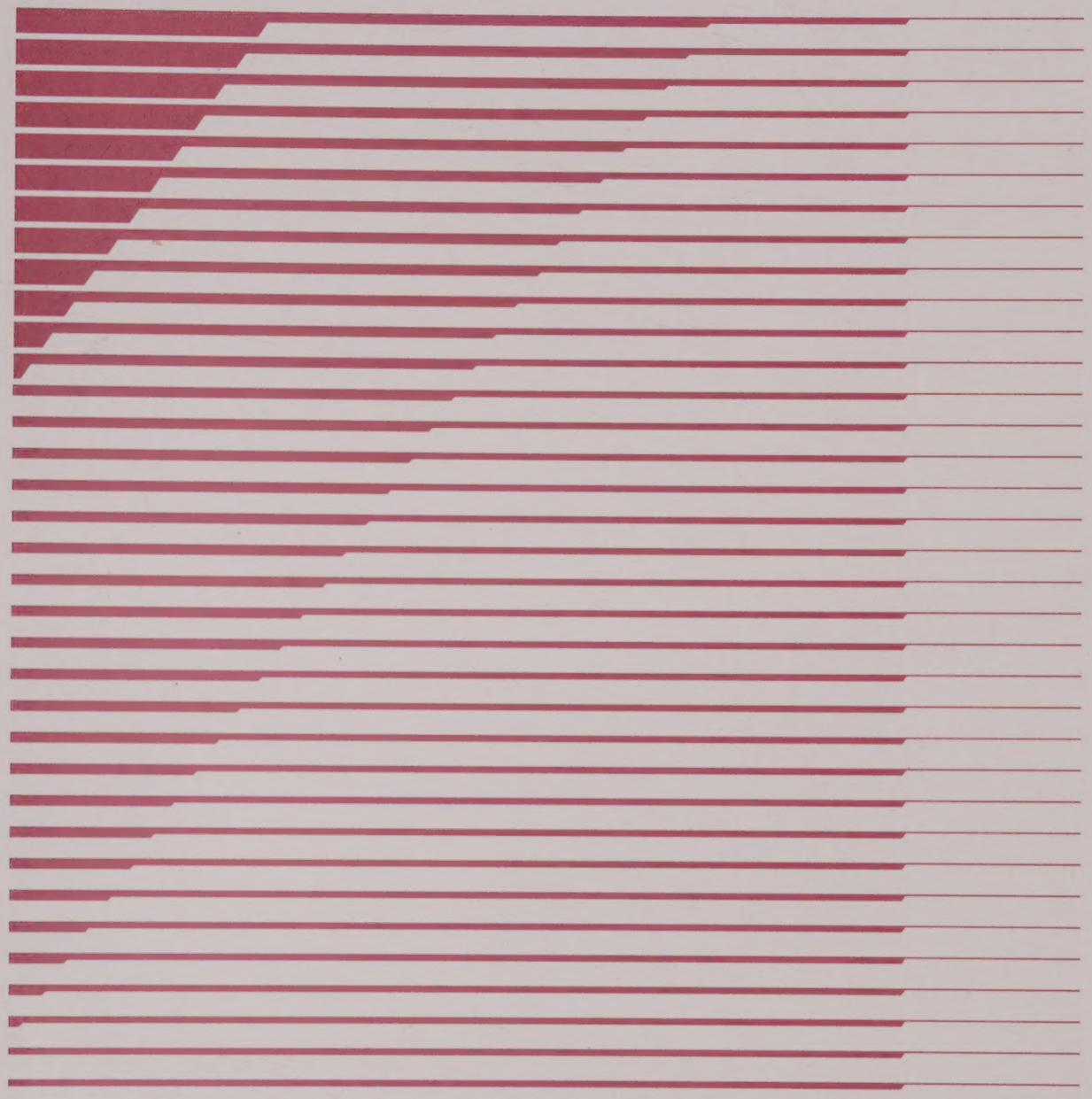

ADVANTEST®

ADVANTEST CORPORATION

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R3765/67G Series

Network Analyzer

Operation Manual

MANUAL NUMBER FOE-8370681G01

Applicable models

R3765AG
R3765BG
R3765CG
R3767AG
R3767BG
R3767CG

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Safety Summary

To ensure thorough understanding of all functions and to ensure efficient use of this instrument, please read the manual carefully before using. Note that Advantest bears absolutely no responsibility for the result of operations caused due to incorrect or inappropriate use of this instrument.

If the equipment is used in a manner not specified by Advantest, the protection provided by the equipment may be impaired.

- **Warning Labels**

  Warning labels are applied to Advantest products in locations where specific dangers exist. Pay careful attention to these labels during handling. Do not remove or tear these labels. If you have any questions regarding warning labels, please ask your nearest Advantest dealer. Our address and phone number are listed at the end of this manual.

  Symbols of those warning labels are shown below together with their meaning.

  DANGER: Indicates an imminently hazardous situation which will result in death or serious personal injury.

  WARNING: Indicates a potentially hazardous situation which will result in death or serious personal injury.

  CAUTION: Indicates a potentially hazardous situation which will result in personal injury or a damage to property including the product.

- **Basic Precautions**

  Please observe the following precautions to prevent fire, burn, electric shock, and personal injury.

  - Use a power cable rated for the voltage in question. Be sure however to use a power cable conforming to safety standards of your nation when using a product overseas.
  - When inserting the plug into the electrical outlet, first turn the power switch OFF and then insert the plug as far as it will go.
  - When removing the plug from the electrical outlet, first turn the power switch OFF and then pull it out by gripping the plug. Do not pull on the power cable itself. Make sure your hands are dry at this time.
  - Before turning on the power, be sure to check that the supply voltage matches the voltage requirements of the instrument.
  - Connect the power cable to a power outlet that is connected to a protected ground terminal. Grounding will be defeated if you use an extension cord which does not include a protected ground terminal.
  - Be sure to use fuses rated for the voltage in question.
  - Do not use this instrument with the case open.
  - Do not place anything on the product and do not apply excessive pressure to the product. Also, do not place flower pots or other containers containing liquid such as chemicals near this

Environmental Conditions

This instrument should be only be used in an area which satisfies the following conditions:

- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations
- Altitude of up to 2000 m

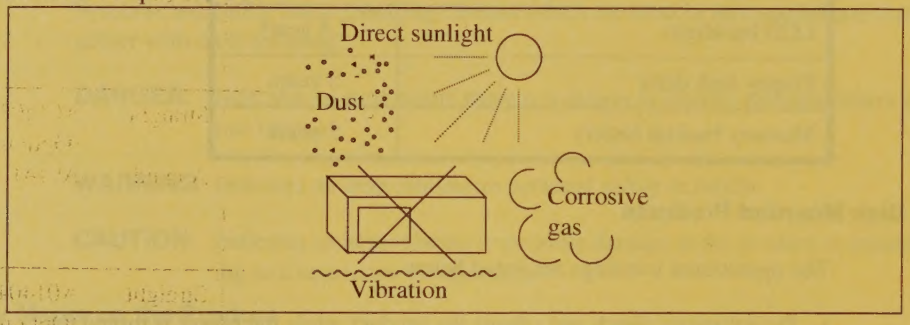

Figure-1 Environmental Conditions

- Operating position

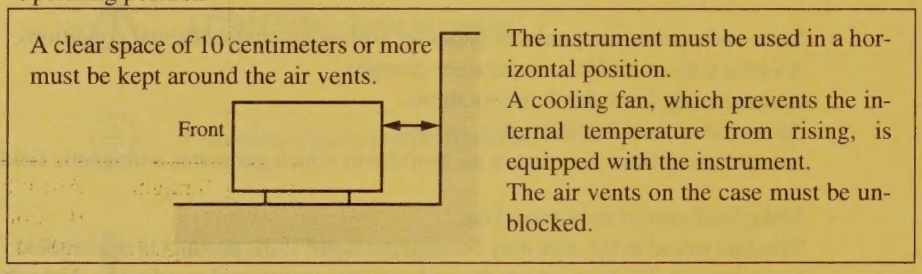
A clear space of 10 centimeters or more must be kept around the air vents.
Front
The instrument must be used in a horizontal position.
A cooling fan, which prevents the internal temperature from rising, is equipped with the instrument.
The air vents on the case must be unblocked.

Figure-2 Operating Position

- Storage position

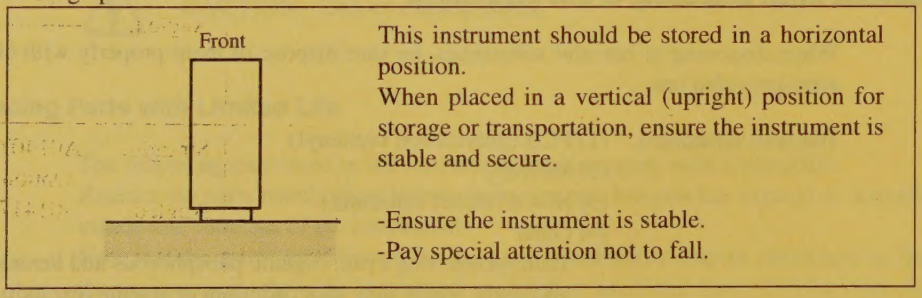
Front
This instrument should be stored in a horizontal position.
When placed in a vertical (upright) position for storage or transportation, ensure the instrument is stable and secure.
-Ensure the instrument is stable.
-Pay special attention not to fall.

Figure-3 Storage Position

- The classification of the transient over-voltage, which exists typically in the main power supply, and the pollution degree is defined by IEC61010-1 and described below.

  Impulse withstand voltage (over-voltage) category II defined by IEC60364-4-443

  Pollution Degree 2

Types of Power Cable

Replace any references to the power cable type, according to the following table, with the appropriate power cable type for your country.

Plug configuration	Standards	Rating, color and length	Model number (Option number)
	PSE: Japan Electrical Appliance and Material Safety Law	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
	UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) Angled: A01413
	CEE: Europe DEMKO: Denmark NEMKO: Norway VDE: Germany KEMA: The Netherlands CEBEC: Belgium OVE: Austria FIMKO: Finland SEMKO: Sweden	250 V at 6 A Gray 2 m (6 ft)	Straight: A01404 (Option 96) Angled: A01414
	SEV: Switzerland	250 V at 6 A Gray 2 m (6 ft)	Straight: A01405 (Option 97) Angled: A01415
	SAA: Australia, New Zealand	250 V at 6 A Gray 2 m (6 ft)	Straight: A01406 (Option 98) Angled: --------
	BS: United Kingdom	250 V at 6 A Black 2 m (6 ft)	Straight: A01407 (Option 99) Angled: A01417
	CCC:China	250 V at 10 A Black 2 m (6 ft)	Straight: A114009 (Option 94) Angled: A114109

Certificate of Conformity

CE

This is to certify, that

Network Analyzer

R3765AG, R3765BG, R3765CG,
R3767AG, R3767BG, R3767CG

instrument, type, designation

complies with the provisions of the EMC Directive 89/336/EEC in accordance with EN50081-1 and EN50082-1 and Low Voltage Directive 73/23/EEC in accordance with EN61010.

ADVANTEST Corp.

Tokyo, Japan

ROHDE&SCHWARZ

Engineering and Sales GmbH
Munich, Germany

3765.02

PREFACE

<In the Beginning>

This manual explains all processes from the acceptance to actual operation of network analyzer R3765/67G series. The manual of three volumes related about the R3765/67G series is shown in the following.

Manual name	Model	Strong points	Remarks
R3765/67G Series Network Analyzer Operation Manual (this manual)	R3765AG		3.8GHz model
	R3765BG	Bridge is built in.	
	R3765CG	S parameter is built in.	
	R3767AG		8.0GHz model
	R3767BG	Bridge is built in.	
	R3767CG	S parameter is built in.	
R3764/65/66/67H Series R3765/67G Series Network Analyzer Programming Manual (separate volume)	This manual is shared between all models of R3765/67G series.		
R3752/53/64/65/66/67G Series R3765/67G Series R3754 Series Network Analyzer Programming Guide (separate volume)	This manual is shared between all models of R3765/67G series.		

<Caution>

ADVANTEST reserves the right to change the content of this manual and other product information without notice.

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The address and the telephone number of ADVANTEST Corporation are described in the end of this manual. Refer for the inquiry etc.

<How to Read this Manual>

(1) Distinction of panel key and soft key in this manual.

Panel key : (Example) **[CH 1]** , **[5]**
Soft key : (Example) *{POWER}*, *{LOG MAG}*

(2) Organization of this manual

Configuration	Contents	Remarks
Preface	For the first use. Confirmation of the products and the attachments.	Read before first use.
Contents	Table of Contents, Figures, Tables The configuration and the page of the description.	Use to find necessary information easily.
1.	GETTING STARTED From setting to setup, cautions, cleaning, transportation and storage.	Read before first use.
2.	Explanation of panel side and display screen Name of each device, function and operation. Description of display screen.	Usage of the R3765/67G series can be understood by reading it through.
3.	Basic operating guidelines Actual example of operation. How to look at the display screen.	
4.	Basic operation Description of the basic items.	Chapters of practice.
5.	Measurement method example Concrete examples and operational procedures.	
6.	Record and output Saving to floppy disk and replaying.	
7.	Description of the functions Detailed explanation of each block.	Refer if necessary.
8.	In abnormal Diagnostics and error message.	
9.	Operating principles Basic operation and flow chart.	
10.	Performance test	
11.	Specifications Technical information and general information.	
Appendix	Relation of data between each function Initial setting. Soft key menu list. Other information.	
Others	DIMENSIONAL OUTLINE DRAWING	Use to find the outer dimensions.
Index	Main words and the description page.	Use to find necessary information easily.

TABLE OF CONTENTS

1 GETTING STARTED 1-1

1.1 Product Description 1-1
1.2 Product and Attachment 1-2
1.3 Option, Accessory and Recommended Kit (Extra-cost) 1-3
1.4 Environmental Conditions 1-5
1.5 Supply Description 1-7
1.5.1 Power Supply Specifications 1-7
1.5.2 Replacing the Power Fuse 1-7
1.5.3 Connecting the Power Cable 1-8
1.6 System Setup Cautions 1-9
1.6.1 Notes on the use of Parallel I/O Ports 1-9
1.6.2 Notes on the use of Serial I/O ports 1-9
1.6.3 Note on the Probe Connector 1-9
1.7 Measurement Time 1-9
1.8 Input Signal Level Overload Cautions 1-9
1.9 How to Replace the Protective Fuse for Bias Input 1-10
1.10 Cleaning, Storage and Transportation 1-11
1.11 Notes on Use 1-12
1.12 Calibration 1-14
1.13 Replacing Parts with Limited Life 1-14

2 PANEL DESCRIPTION 2-1

2.1 Front Panel Descriptions 2-1
2.1.1 R3765AG/67AG 2-1
2.1.2 R3765BG/67BG 2-3
2.1.3 R3765CG/67CG 2-5
2.1.4 R3765CG/67CG (OPT11) 2-7
2.1.5 R3765CG/67CG (OPT14) 2-9
2.2 Rear Panel Descriptions 2-11
2.3 Screen Display Descriptions 2-13

3 BASIC OPERATING GUIDELINES 3-1

3.1 Initial Power-on 3-1
3.2 Operation Keys 3-3
3.2.1 Panel Keys and Soft Keys 3-3
3.3 How to Read the Display Screen 3-7
3.4 Basic Measuring Procedure 3-8
3.5 Measurement Samples of Simple Transmission Characteristics 3-9
3.5.1 Setup and Setting 3-9
3.5.2 Calibration (Normalize) 3-11
3.5.3 Magnitude measurement 3-12

3.5.4 Phase measurement 3-15
3.5.5 Group delay measurement 3-17
3.6 Measurement Samples of Simple Reflection Characteristics 3-20
3.6.1 Setup 3-20
3.6.2 Calibration (1-port full calibration) 3-22
3.6.3 Measurement by various formats 3-25

4 BASICS OPERATION 4-1

4.1 Basic Keys Operations 4-1
4.2 Basic Key Operation Examples 4-1
4.3 Soft Key Menu Configuration 4-2
4.4 Initial Setup 4-3
4.4.1 How to Initialize 4-3
4.4.2 Initial Setup Value 4-3
4.5 Setting Backup Memory (Factory Default Settings) 4-7

5 MEASUREMENT METHOD EXAMPLE 5-1

5.1 Measurement of Transmission Characteristic (2 Trace Display) 5-1
5.1.1 Overlap Display Mode (Two Traces per Screen Measurement) 5-1
5.1.2 Split Display 5-6
5.2 Transmission/Reflection Characteristic Measurement (Four Screen Display Mode) 5-10
5.2.1 Setup 5-10
5.2.2 Calibration (two port full calibration) 5-11
5.2.3 Four Screen Display 5-19
5.3 Narrow Band/Wide Band Sweep Measurement 5-25
5.4 Multi-marker List Display 5-28
5.5 Ripple Measurement in the Bandwidth 5-31
5.6 Measurement of Electrical Length 5-36
5.7 High-speed Measurement Using the Program Sweep Function 5-40
5.8 GO/NG Measurement Using Limit Line Function 5-45

6 RECORD and OUTPUT 6-1

6.1 Output of Measured Data to the Plotter 6-1
6.2 Using the Save/Recall Register 6-5
6.3 Saving to the Floppy Disk 6-7
6.3.1 About the Measurement Data to Save 6-9

7 FUNCTION DESCRIPTIONS 7-1

7.1 ACTIVE CHANNEL Block 7-1
7.2 ENTRY Block 7-3
7.3 STIMULUS Block 7-5

7.3.1 Setting Signal Source 7-6
7.3.2 Interlocking between Channels 7-8
7.4 RESPONSE Block 7-9
7.4.1 Setting Input and Parameter Conversion 7-10
7.4.2 Display Data Format 7-14
7.4.3 Setting Display Coordinate Scale 7-15
7.4.4 Four Screen Display and Display Selection Information 7-16
7.4.5 Display Layout 7-18
7.4.6 Trace Data Selection 7-23
7.4.7 TRACE Operation 7-24
7.4.8 Label Input 7-25
7.4.9 Colors Settings 7-26
7.4.10 Averaging/Smoothing and Resolution Bandwidth 7-28
7.5 Calibration 7-31
7.5.1 Normalizing 7-31
7.5.2 Normalize & Isolation Calibration 7-32
7.5.3 1-Port Full Calibration 7-32
7.5.4 2-Port Full Calibration (R3765CG/67CG only) 7-34
7.5.5 Calibration Method 7-36
7.5.6 Interpolating Calibration Data 7-42
7.5.7 Calibration Kit Selection 7-43
7.5.8 Parameters Entry of an User-selected Calibration Kit 7-44
7.5.9 Extending Measurement Reference Plane 7-47
7.5.10 Calibration Data Clear 7-50
7.5.11 3-Port Full Calibration 7-51
7.5.12 4-Port Full Calibration 7-58
7.6 Marker Function 7-64
7.6.1 Setting Marker 7-65
7.6.2 Marker Coupling between Channels 7-66
7.6.3 Interpolation between Measurement Points 7-68
7.6.4 Displaying Marker Read out Value 7-68
7.6.5 Delta-Marker Function 7-69
7.6.6 Marker Menu during Impedance Measurement 7-72
7.6.7 Marker Analysis Function 7-73
7.7 Time Domain Function(OPT 70) 7-84
7.7.1 Time Domain Transformation Function 7-84
7.7.2 Window Processing 7-86
7.7.3 Gate Function 7-87
7.7.4 Time Domain Transformation Mode 7-88
7.7.5 Transformation of the Time Domain Horizontal Axis 7-88
7.8 CDMA IF Filter Analysis Function 7-89
7.9 Sweep 7-93
7.9.1 Setting Sweep Type 7-93
7.9.2 Editing Segment of User Frequency Sweep 7-94

7.9.3 Editing Segment of Program Sweep 7-95
7.10 Software Fixture Function (OPT 71/72) 7-98
7.10.1 Overview 7-98
7.10.2 Function 7-99
7.10.3 Measurement Example 7-119
7.11 INSTRUMENT STATE Block 7-127
7.11.1 System Menu 7-128
7.11.2 System Configuration 7-130
7.11.3 Service Function 7-131
7.12 Limit Function 7-132
7.12.1 Limit Menu 7-132
7.13 GPIB Block 7-138
7.13.1 Controller Menu 7-139
7.13.2 GPIB Menu 7-140
7.14 Save/Recall 7-141
7.14.1 Selection of Save Type 7-141
7.14.2 Executing Save Register 7-142
7.14.3 Executing Store File 7-144
7.14.4 Setting Register Name 7-145
7.14.5 Setting File Name 7-146
7.14.6 Clearing Saved Register 7-147
7.14.7 Purging Stored File 7-148
7.14.8 Executing Recall 7-148
7.15 Hard Copy 7-151
7.15.1 Setting Plot Scale 7-152
7.15.2 Selecting Plot Data 7-153
7.15.3 Specifying Pen 7-153
7.15.4 Plotter Setup 7-154
7.15.5 Printer Setup 7-156
7.15.6 Bitmap File Setup 7-158
7.16 Communication with Peripheral Devices 7-159
7.16.1 Parallel I/O Port 7-159
7.16.2 RS-232 Interface 7-168

8 IN ABNORMALITIES 8-1

8.1 Inspection and Simple Troubleshooting 8-1
8.2 Error Messages 8-2
8.2.1 Hardware Trouble 8-2
8.2.2 Notice of Hardware Information 8-3
8.2.3 Operating Error 8-4
8.2.4 Warning of Internal Set, Change, etc. 8-9
8.2.5 Completed Operation Conditions Messages 8-12

9 PRINCIPLE 9-1
9.1 Principle 9-1
9.2 Data Flow 9-2

10 PERFORMANCE TEST 10-1
10.1 Preparing for a Performance Test 10-1
10.1.1 Warm up 10-1
10.1.2 Preparing Measurement Instrument 10-1
10.1.3 General Note 10-3
10.2 Frequency Accuracy and Range 10-4
10.3 Output Level Accuracy and Flatness 10-5
10.3.1 Setup 10-5
10.3.2 Output Level Accuracy 10-5
10.3.3 Flatness 10-6
10.4 Output Level Linearity 10-8
10.5 Directivity 10-11
10.6 Load Match of Test Port 10-14
10.6.1 When R3765AG/67AG 10-14
10.6.2 When R3765BG/67BG 10-16
10.6.3 When R3765CG/67CG 10-17
10.7 Noise Level 10-21
10.8 Crosstalk 10-24
10.8.1 When R3765AG/67AG 10-24
10.8.2 When R3765BG/67BG 10-26
10.8.3 When R3765CG/67CG 10-27
10.8.4 When R3765CG/67CG (OPT 11/OPT 13/OPT 14) 10-29
10.9 Dynamic Level Accuracy 10-47
10.9.1 Dynamic Level Accuracy for the R3765AG/67AG 10-47
10.9.2 Dynamic Level Accuracy for the R3765BG/67BG 10-52
10.9.3 Dynamic Level Accuracy for the R3765CG/67CG 10-54
10.9.4 Dynamic Level Accuracy for the R3765CG/67CG (OPT11/OPT13/OPT14) 10-58
10.10 Attenuation Accuracy (OPT10) 10-67
10.10.1 Specifications 10-67
10.10.2 Instruments Required 10-67
10.10.3 Testing Procedure 10-67

11 SPECIFICATIONS 11-1

APPENDIX A-1
A.1 The Relation of Data between each Function A-1
A.1.1 The Relation of Data between each Channel and each Function A-1
A.1.2 The Data Interlocking to each Item in MEAS Menu. A-2

A.2 Measuring Time A-3
A.3 Initial Setting A-4
A.4 Soft Key Menu List A-9
A.5 Other Information A-32
A.5.1 Error Message..... A-32
A.5.2 Setting of Backup Memory (at the factory-shipped)..... A-32
A.5.3 GPIB Command List for Panel Key/Soft Key A-32

DIMENSIONAL OUTLINE DRAWING EXT-1

ALPHABETICAL INDEX I-1

LIST OF ILLUSTRATIONS

No.	Title	Page
1-1	Operating Environment	1-5
1-2	Human Body	1-13
1-3	Floor in the Work Area	1-13
1-4	Benchboard	1-13
2-1	Front-Panel Descriptions (R3765AG/67AG)	2-1
2-2	Front-Panel Descriptions (R3765BG/67BG)	2-3
2-3	Front-Panel Descriptions (R3765CG/67CG)	2-5
2-4	Front-Panel Descriptions (R3765CG/67CG (OPT 11))	2-7
2-5	Front-Panel Descriptions (R3765CG/67CG (OPT 14))	2-9
2-6	Rear Panel Descriptions	2-11
2-7	Screen Display Descriptions	2-13
3-1	Connecting the Power Cable	3-1
3-2	Setting Screen When Switch on or Preset	3-2
3-3	Panel Keys and Soft Keys	3-3
3-4	Displayed Active Area	3-5
3-5	How to Set Data	3-6
3-6	Annotation on the Screen (Annotation Character)	3-7
3-7	The Setup of Transmission Characteristic Measurement (AG Type)	3-9
3-8	The Setup of Transmission Characteristic Measurement (BG/CG Type)	3-9
3-9	Screen of Frequency Characteristic Normalize	3-11
3-10	Auto-scale of Magnitude Measurement	3-12
3-11	Filter Analyzing Function (3dB Bandwidth and Q Measurement)	3-13
3-12	Filter Analyzing Function (6dB Bandwidth and Q Measurement)	3-14
3-13	Auto-scale of Phase Measurement	3-16
3-14	Phase Extension Display	3-16
3-15	Auto-scale of Group Delay Measurement	3-18
3-16	Change of Group Delay Aperture	3-19
3-17	Setup for Reflection Characteristic Measurement (AG type)	3-20
3-18	Setup for Reflection Characteristic Measurement (BG/CG Type)	3-21
3-19	1-Port Full Calibration (Open)	3-23
3-20	1-Port Full Calibration (Short)	3-23
3-21	1-Port Full Calibration (Load)	3-24
3-22	Return Loss Measurement	3-25
3-23	Reflection Coefficient Measurement	3-26
3-24	Standing Wave Ratio (SWR) Measurement	3-27
3-25	S Parameter Measurement	3-28
3-26	Impedance Measurement	3-29
5-1	Auto-scale of the First Trace of Magnitude/Phase Measurement (Overlap Display)	5-2
5-2	Auto-scale of the Second Trace of Magnitude/Phase Measurement (Overlap Display)	5-3
5-3	Logarithmic Magnitude/Group Delay Measurement (Overlap Display)	5-4

List of Illustrations

No.	Title	Page
5-4	Linear Magnitude/Phase Measurement (Overlap Display)	5-5
5-5	Logarithmic Magnitude/Phase Measurement (Split Display)	5-7
5-6	Logarithmic Magnitude/Group Delay Measurement (Split Display)	5-8
5-7	Linear Magnitude/Phase Measurement (Split Display)	5-9
5-8	Setup of the Reflection Characteristic Measurement	5-10
5-9	Calibration of 2-Port Reflection (Test Port/Open)	5-11
5-10	Calibration of 2-Port Reflection (Test Port/Short)	5-12
5-11	Calibration of 2-Port Reflection (Test Port/Load)	5-13
5-12	Execution of 2-Port Reflection Characteristic Calibration	5-14
5-13	Calibration of 2-Port Transmission Characteristic (Forward Direction)	5-15
5-14	Execution of 2-Port Transmission Characteristic Calibration	5-16
5-15	Execution of the Isolation Calibration	5-17
5-16	Execution of 2-Port Full Calibration	5-18
5-17	4 Screen Display (Channel 1)	5-19
5-18	4 Screen Display (Overlap Display of Channel 1 and 3)	5-20
5-19	4 Screen Display (Split Display of Channel 1 and 3)	5-21
5-20	4 Screen Display (Channel 2)	5-22
5-21	4 Screen Display (Split Display of Channel 2 and 4)	5-23
5-22	The Finished 4 Screen Display	5-24
5-23	Two Channels Simultaneous Display (Overlap Display)	5-26
5-24	Two Channels Simultaneous Display (Split Display)	5-27
5-25	Multi-marker Display	5-29
5-26	Display of Multi-marker List	5-30
5-27	Specification of Delta Section (Partial Search)	5-32
5-28	Measurement of Maximum Value in the Delta section	5-33
5-29	Measurement of Minimum Value in the Delta Section	5-34
5-30	Measurement of Ripple in the Delta Section	5-35
5-31	Electrical Length of Cable	5-37
5-32	Electrical Length Correction Mode	5-38
5-33	Measurement of Electrical Length	5-39
5-34	Linear Sweeping	5-40
5-35	Setting of Program Sweeping	5-41
5-36	Execution of the Program Sweep	5-43
5-37	Change of the Program Sweep	5-44
5-38	Screen before Execution of Limit Line Measurement	5-45
5-39	Setting of the Limit Line	5-46
5-40	Limit Line Editing	5-47
5-41	Setting of Segment 0	5-48
5-42	Setting of Each Segment	5-49
5-43	Execution of Limit Test	5-50
5-44	Change of Limit Line	5-51
6-1	Setting of Plotter GPIB Address	6-1
6-2	Change of Plotter Initial Setup Value (Initial Value)	6-2
6-3	Output Data to the Plotter	6-3
6-4	Output Result of the Plotter	6-4
6-5	Saving into the Save-Register	6-5

No.	Title	Page
6-6	Recalling from the Recall-register	6-6
6-7	Saving to the Floppy Disk	6-8
6-8	Recall from Floppy Disk	6-9
7-1	Delta-Marker Function	7-69
7-2	Band Pass Filter Analysis/MAX Reference	7-79
7-3	Band Pass Filter Analysis/Active Marker Reference	7-80
7-4	Band Pass Filter Analysis/Reference Line Reference	7-80
7-5	Notch Filter Analysis/MAX Reference	7-81
7-6	Notch Filter Analysis/Active Marker Reference	7-81
7-7	Notch Filter Analysis/Reference Line Reference	7-82
7-8	Example of Filter Analysis Execution	7-82
7-9	The Screen before the Segment Edited	7-96
7-10	The Screen after the Segment Edited	7-97
7-11	Measurement Flow Used with OPT 71	7-98
7-12	Measurement Flow Used with Network Elimination Function	7-99
7-13	Dynamic Range When Changing the Impedance	7-100
7-14	Reflection Parameter	7-101
7-15	Transmission Parameter	7-101
7-16	Transformer	7-102
7-17	Measurement Jig for Balanced Input and Balanced Output Filter	7-119
7-18	File List Display	7-142
7-19	Label Window Display	7-145
7-20	Register List Display	7-145
7-21	Setting DIP Switches	7-155
7-22	Timing Chart of WRITE STROBE	7-159
7-23	Parallel I/O (36-pin) Connector Pin Assignment and Signal	7-161
7-24	Schematic Circuit Diagram of Parallel I/O Port	7-162
9-1	Data Flow	9-2
10-1	Frequency Accuracy and Range	10-4
10-2	Output Level Accuracy and Flatness	10-5
10-3	50W to 75W Conversion Adapter	10-6
10-4	Output Level Linearity	10-8
10-5	Directivity	10-11
10-6	Load Match Measurement of A PORT (R3765AG/67AG)	10-14
10-7	Load Match Measurement of B PORT (R3765AG/67AG)	10-15
10-8	Setup (R3765BG/67BG)	10-16
10-9	Load Match Measurement of TEST PORT 1 (R3765CG/67CG)	10-17
10-10	Load Match Measurement of TEST PORT 2 (R3765CG/67CG)	10-18
10-11	Load Match Measurement of TEST PORT 3 (OPT11/OPT14)	10-19
10-12	Crosstalk Measurement of A PORT (R3765AG/67AG)	10-24
10-13	Crosstalk Measurement of B PORT (R3765AG/67AG)	10-25
10-14	Setup (R3765BG/67BG)	10-26
10-15	Crosstalk of TEST PORT 1 (R3765CG/67CG)	10-27
10-16	Crosstalk of TEST PORT 2 (R3765CG/67CG)	10-28
10-17	Crosstalk of TEST PORT 1 (When the measurement path is S12)	10-29

No.	Title	Page
10-18	Crosstalk of TEST PORT 1 (When the measurement path is S13)	10-31
10-19	Crosstalk of TEST PORT 1 (When the measurement path is S14)	10-33
10-20	Crosstalk of TEST PORT 2 (When the measurement path is S21)	10-34
10-21	Crosstalk of TEST PORT 2 (When the measurement path is S23)	10-36
10-22	Crosstalk of TEST PORT 2 (When the measurement path is S24)	10-38
10-23	Crosstalk of TEST PORT 3 (When the measurement path is S31)	10-39
10-24	Crosstalk of TEST PORT 3 (When the measurement path is S32)	10-41
10-25	Crosstalk of TEST PORT 3 (When the measurement path is S34)	10-43
10-26	Crosstalk of TEST PORT 4 (When the measurement path is S41)	10-44
10-27	Crosstalk of TEST PORT 4 (When the measurement path is S42)	10-45
10-28	Crosstalk of TEST PORT 4 (When the measurement path is S43)	10-46
10-29	Connections for A PORT Measurement for Dynamic Level Accuracy	10-48
10-30	Connections for B PORT Measurement for Dynamic Level Accuracy	10-50
10-31	Connections for TEST PORT 1 Measurement for Dynamic Level Accuracy	10-52
10-32	Connections for TEST PORT 2 Measurement for Dynamic Level Accuracy	10-55
10-33	Connections for TEST PORT 1 Measurement for Dynamic Level Accuracy	10-57
10-34	Connections for TEST PORT 2 Measurement for Dynamic Level Accuracy	10-59
10-35	Connections for TEST PORT 1 Measurement for Dynamic Level Accuracy	10-61
10-36	Connections for TEST PORT 3 Measurement for Dynamic Level Accuracy	10-63
10-37	Connections for TEST PORT 4 Measurement for Dynamic Level Accuracy	10-65
10-38	Connections for Attenuation Accuracy Measurements	10-67

LIST OF TABLES

No.	Title	Page
2-1	Front-Panel Descriptions (R3765AG/67AG)	2-2
2-2	Front-Panel Descriptions (R3765BG/67BG)	2-4
2-3	Front-Panel Descriptions (R3765CG/67CG)	2-6
2-4	Front-Panel Descriptions (R3765CG/67CG (OPT11))	2-8
2-5	Front-Panel Descriptions (R3765CG/67CG (OPT14))	2-10
2-6	Rear Panel Descriptions (R3765CG/67CG)	2-12
2-7	Screen Display Descriptions	2-14
4-1	Initial Setup Value (1 of 3)	4-3
4-2	Setting Backup Memory	4-7
7-1	Combination of Interpolatable Sweep Type (o; possible, x; impossible)	7-42
7-2	Status Display	7-42
7-3	DSW1 Function	7-155
7-4	DSW2 Function	7-156
10-1	Required Measurement Instrument for Performance Test (1 of 3)	10-1
10-2	Check Point for the R3765AG/67AG	10-49
10-3	Check Point for the R3765BG/67BG	10-53
10-4	Check Point for the R3765CG/67CG	10-56
10-5	Check Point for the R3765CG/67CG (For OPT 11, OPT 13 and OPT 14)	10-60

1 GETTING STARTED

This chapter gives a brief explanation of product, its working environment and operational precautions. Read this chapter before you use the product.

1.1 Product Description

R3765/67G series is the 3.8GHz/8GHz vector network analyzer, which has newly been designed based on a concept "an optimum tool for each application".

We have fully pursued high throughput such as 0.15ms/points high-speed measurement at a resolution bandwidth (RBW) of 20kHz, 100dB wide dynamic-range measurement, and two-device simultaneous measurement with four-channel/eight-trace display.

Also, we have added the program sweeping function that can freely change the resolution bandwidth (RBW) and output level during sweep operation for each segment.

With the built-in BASIC controller, a high-speed ATE system can be easily configured with no external controller for processes from adjustment to inspection.

<Features>

(1) High throughput

- For the C type, four S parameters can be displayed simultaneously using a high-speed frequency sweep of 0.15 ms/point and the 4ch/8 trace.

(2) Wide dynamic range

- 100dB wide dynamic range.

(3) Program sweeping function.

- For each segment, allows setting of frequency, output level, RBW and settling time.

(4) MS-DOS formatted disk

- By using an MS-DOS personal computer, it is possible to easily create programs and analyze data because of the disk conformed to MS-DOS format standard.
- Three modes of storage capacity available (DD 720KB, HD 1.2MB, HD 1.4MB).

1.2 Product and Attachment

(1) Standard attachment lists.

Note: Order the addition of the attachment etc. with type name or stock No.

Name of articles	Type name	Parts code	Quantity	Remarks
Power cable	A01402	DCB-DD2428X01	1	3pins plug
AC adapter	-	JCD-AL003EX03	1*1	3→2pin
Power fuse	-	DFT-AA6R3A	1	T6.3A/250V
R3765/67G Series Network Analyzer Operating Manual	-	ER3765/67H SERIES	1	English
R3764/65/66/67H Series R3765/67G Series Network Analyzer Programing Manual	-	ER3764H (PM)	1	English
R3752/53/64/65/66/67H Series R3765/67G Series R3754 Series Network Analyzer Programing Guide	-	ER3752/64H (PG)	1	English

Note: *1 : The AC adaptor is a standard attachment only to Japan-domestic.

1.3 Option, Accessory and Recommended Kit (Extra-cost)

(1) Option

Name	Option								Remarks
	OPT 10	OPT 11	OPT 12	OPT 13	OPT 14	OPT 70	OPT 71	OPT 72	
R3765AG	○					○			3.8 GHz without the built-in test set
R3765BG	○		○			○			3.8 GHz with the built-in bridge
R3765CG	○	○	○	○	○	○	○	○	3.8 GHz with the built-in test set
R3767AG	○					○			8 GHz without the built-in test set
R3767BG	○					○			8 GHz with the built-in bridge
R3767CG	○	○			○	○	○	○	8 GHz with the built-in test set

NOTE: OPT11 and OPT12, OPT13 or OPT14 cannot be installed concurrently.
OPT12 and OPT13, OPT14, OPT71 or OPT72 cannot be installed concurrently.
OPT13 and OPT14, OPT71, or OPT72 cannot be installed concurrently.

Option	
OPT10	Output attenuator (electronic-type)
OPT11	Built-in 3-port test set
OPT12	Impedance : 75Ω
OPT13	Impedance : 75Ω , Built-in 3-port test set
OPT14	Built-in 4-port test set
OPT70	Time domain balance (Software)
OPT71	Software Fixture to measure balancing (Software)
OPT72	Software fixture single (Software)

(2) Accessory

Name	Type	Remarks
Rack-mount kit	A02713	JIS (Front handle attached)
	A02712	EIA (Front handle attached)
Slide rail set	A02642	

(3) Recommended kit

Name	Type	Remarks	
		Frequency range	Connector type
Calibration kit: 50Ω	Model 9617A3	DC to 18GHz	N type
Calibration kit: 50Ω	Model 9617F3	DC to 18GHz	3.5mm type
Calibration kit: 50Ω	Model 9617C3	DC to 4GHz	N type
Calibration kit: 50Ω	Model 9617H3	DC to 4GHz	3.5mm type
Calibration kit: 75Ω	Model 9617M3	DC to 3.8GHz	N type
Automatic calibration kit: 50Ω	R17050	40MHz to 8GHz	3.5mm type

1.4 Environmental Conditions

- Operating Environment
  - Avoid operation in the following areas.
  - Use a noise cut filter when there is a large amount of noise riding on the power line.

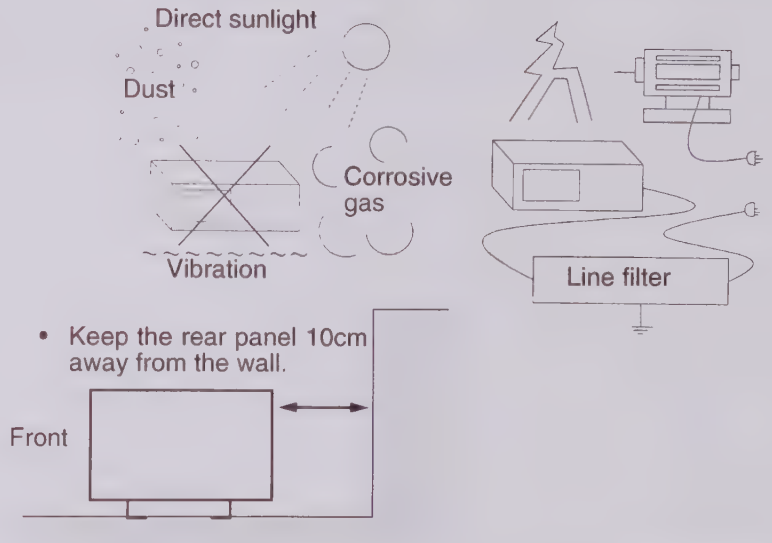


Figure 1-1 Operating Environment

The R3765/67G series should be installed in an area which satisfies the following canditions:

- Ambient temperature : +5°C to +40°C (Operating temperature range: When FDD is used.)
  0°C to +50°C (Operating temperature range: When FDD is not used.)
  -20°C to +60°C (Storage temperature range)
- Relative humidity : PH80% or less (no condensation)
- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations
- A low noise area
  Although the R3765/67G series has been designed to withstand a certain amount of noise riding on the AC power line, it should be used in an area of low noise. Use a noise cut filter when ambient noise is unavoidable.
  For highly accurate measurement, turn the power ON after the R3765/67G series temperature has reached the room temperature level, and warm up the R3765/67G series for 30 minutes.
- Installation position
  The R3765/67G series has an air outlet hole on its rear panel. Never block or plug the hole, as the resulting internal temperature rise will affect measurement accuracy.

The R3765/67G series can be used safely under the following conditions:

- Altitude of up to 2000 m
- Installation Categories II
- Pollution degree 2

1.5 Supply Description

1.5.1 Power Supply Specifications

WARNING!
Safety use the R3765/67G series according to the power requirement.
The R3765/67G series might be damaged in the case not following the power requirement.

The power requirement of the R3765/67G series is shown in the following.
Use the power supply by which the power requirement of the R3765/67G series is satisfied.

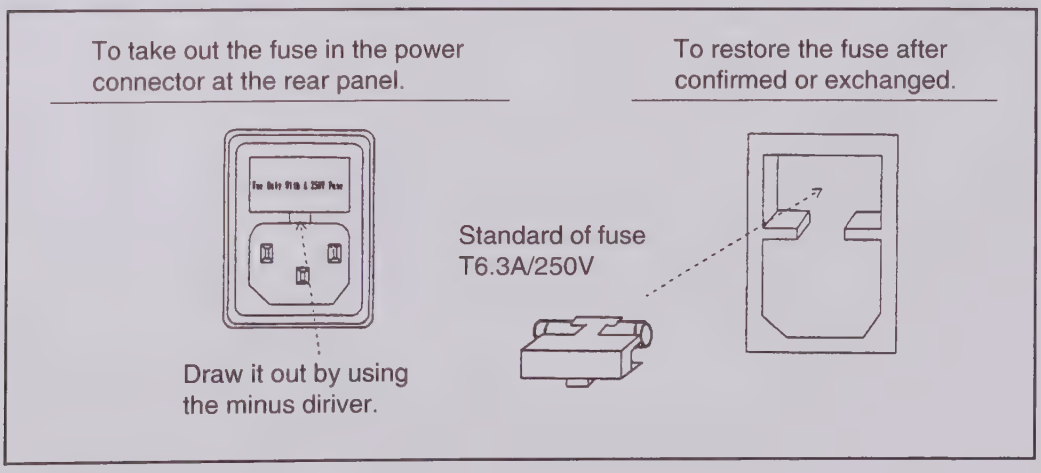
	$100V_{AC}$ operation	$220V_{AC}$ operation
Input voltage range	90V - 132V	198V - 250V
Frequency range	48Hz - 66Hz	
Power fuse	T6.3A/250V	
Power consumption	250VA or below	

*The supply voltage of the R3765/67G series is automatically changed over (100/240V).

1.5.2 Replacing the Power Fuse

WARNING!
1. ***Before replacing the power fuse, be sure to turn the power switch OFF and remove the power cable from the outlet.***
2. ***For continued protection against fire hazard, use a fuse of the type and rating which match the supply voltage.***

Power fuse is located in the power connector on the rear panel.
To check or replace the power fuse as follows.


To take out the fuse in the power connector at the rear panel.
To restore the fuse after confirmed or exchanged.
Standard of fuse
T6.3A/250V
Draw it out by using the minus diriver.

1.5.3 Connecting the Power Cable

WARNING!

1. Power cable

- ***Use power cable of the attachment for prevention electric shock and fire.***
- ***Use power cable in accordance with the safety standard of the country for use excluding Japan.***
- ***When you connect power cable with the outlet, turn off the power switch.***
- ***When you pull out power cable from the outlet, have the plug.***

2. Protective earth

- ***Connect the power plug cable with the power outlet which has the protective earth terminal.***
- ***If the code for the extension without the protective earth terminal is used, the protective earth will become invalid.***

(1) Power plug for overseas use

A separately-sold plug for overseas use is available. For more information, contact ADVANTEST's Service Department.

1.6 System Setup Cautions

1.6.1 Notes on the use of Parallel I/O Ports

(1) In +5V power output from parallel I/O port, maximum current capacity is 100mA. Use it within 100mA.

(2) An overcurrent protective device is installed in the +5 V power supply, which supplies power through the parallel I/O port. If an overcurrent flow of more than 100 mA occurs, the power supply shuts down.
When the problem causing the overcurrent is solved, the power supply is automatically resumed.

(3) Use the shield cable for the cable for parallel I/O port. (To prevent malfunction by noise)

(4) The standard of the cable for the radiation test of the R3765/67G series is MO-27.

(5) Do not bundle I/O cable and AC power line when wiring.

1.6.2 Notes on the use of Serial I/O ports

(1) The length of the cable used for serial I/O port is 15 m or less.

(2) Use the shield cable for the cable for serial I/O port. (To prevent malfunction by noise)

(3) The standard of the cable used for the radiation test of the R3765/67G series is A01235.

(4) Do not bundle I/O cable and AC power line when wiring.

1.6.3 Note on the Probe Connector

When a cable is connected to the probe connector for any purposes other than the automatic calibration kit (R17050), the cable must have countermeasures against radiation installed.
For more information on countermeasures against radiation, contact an ADVANTEST service representative.

1.7 Measurement Time

The sweeping time of the R3765/67G series is determined by frequency set-up time and data acquiring time.

As the SWEEP TIME on the display screen shows the data acquiring time, the actual sweep time becomes longer than the displayed SWEEP TIME under the influence of frequency set-up time.

Refer to APPENDIX for details.

1.8 Input Signal Level Overload Cautions

The maximum measurable levels at the input section are as follows.

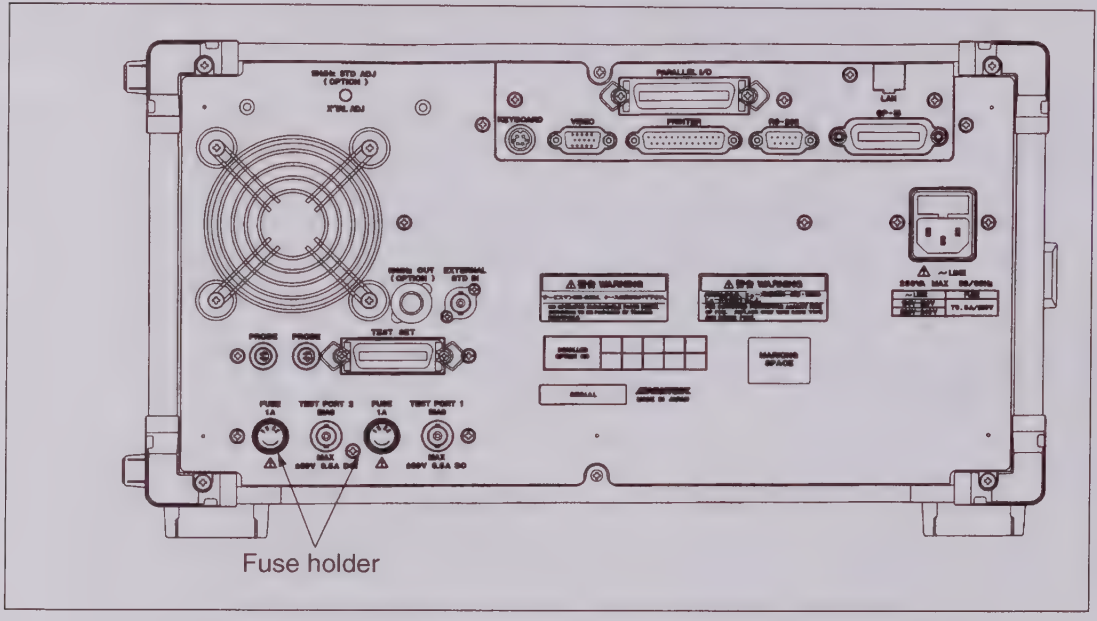
R3765AG/67AG: 0dBm
R3765BG/67BG: 6dBm
R3765CG/67CG: +12dBm
(OPT12 or OPT13: +20dBm)

If more than about 5dB over the maximum level is input, "Overload" is displayed.

1.9 How to Replace the Protective Fuse for Bias Input

For R3765CG/67CG type, the protective fuse for TEST PORT input bias is located in the fuse holder on the rear panel.

Note: ***When the protective fuse for bias input is replaced, turn OFF the POWER switch of the R3765/67G series and remove the power cable from the receptacle beforehand.***



Replacement procedure

① Turn the cap of fuse holder counterclockwise to remove.

② Take out this turned part and replace the fuse.

③ Install the turned part.

- Tighten clockwise.

Standard of protective fuse for bias input
Name of type: TMF51NR1(250)
Part code : DFT-AA6R3A
Rating : Fast blow, 250V, 1A

WARNING!
When the fuse is replaced, use the same type and the same rating of fuse to protect against the danger of fire.

1.10 Cleaning, Storage and Transportation

(1) Cleaning

Wipe the dirt of the R3765/67G series off with a soft cloth (or wet cloth). At this time, attend to the following points.

- Do not remain the fluff of the cloth and do not soak water into the internal of the R3765/67G series.
- Do not use an organic solvent (for example, benzene and acetone, etc.) which changes plastics in quality.

(2) Storage

Storage temperature of the R3765/67G series is from -20°C to +60°C. Do not store it out of this temperature range.
The cases in which the R3765/67G series is not used for a long time, cover with the vinyl cover or put in the cardboard box and prevent dust. Keep it in a dry place where dust and direct sunshine are prevented.

(3) Transportation

When you transport the R3765/67G series, pack it equally to the first packing material or any more.

Packing procedure

① Wrap the R3765/67G series itself with cushion material and put in the cardboard box.

② After putting attachment, put cushion again.

③ Shut the lid of the cardboard box. Fix the outside with a string or tape.

1.11 Notes on Use

(1) Before starting the measurement

When turning on the power, don't connect DUT.
Before starting the measurement, check to see the output power level.

(2) Removing of case

Do not open the case to one except service man of our company.
The R3765/67G series has a high temperature part and a high pressure part.

(3) When abnormality occurs

When smoke rises from the R3765/67G series, smell nastily, or rear unusual sound feel, turn off the power switch. Pull out power cable from the outlet. And contact to our company. The address and the telephone number of our company are in the end of this manual.

(4) Warm up

After the R3765/67G series temperature has reached the room temperature level, turn the power switch ON and warm it up for 30 minutes.

(5) Electromagnetic interference.

High frequency noise of the small power is generated at the R3765/67G series use. Therefore, electromagnetic interference is generated to the television or the radio by an improper installation and use of the R3765/67G series.
If the power of the R3765/67G series is turned off, and the electromagnetic interference is reduced, then the R3765/67G series is the cause it.
Prevent electromagnetic interference by the following procedure.

- Change the direction of antenna of the television or the radio.
- Place the R3765/67G series the other side of the television or the radio.
- Place the R3765/67G series away from the television or the radio.
- Use another line of power source for the television or the radio than the R3765/67G series.

(6) Prevention of Elecrostatic Buildup

To prevent damages to semiconductor parts from electrostatic discharge (ESD), the precautions shown below should be taken. We recommend that two or more measures be combined to provide adequate protection from ESD. (Static electricity can easily be built up when a person moves or an insulator is rubbed.)

Countermeasure example

Human body:	Use of a wrist strap (see Figure 1-2).
Floor in the work area:	Installation of a conductive mat, the use of conductive shoes, and grounding (see Figure 1-3).
Benchboard:	Installation of a conductive mat and grounding (see Figure 1-4).

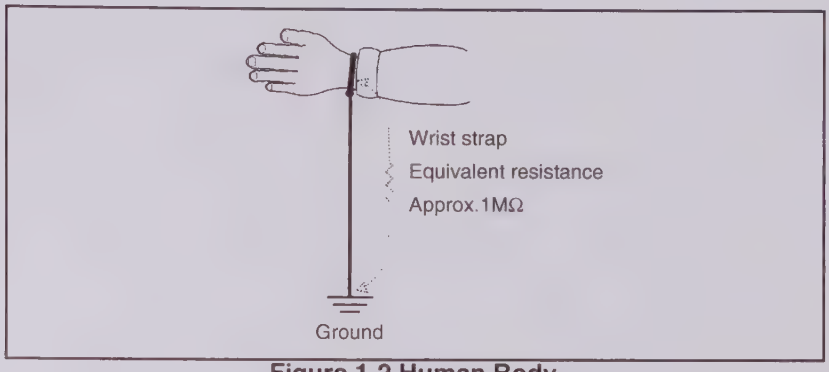


Figure 1-2 Human Body

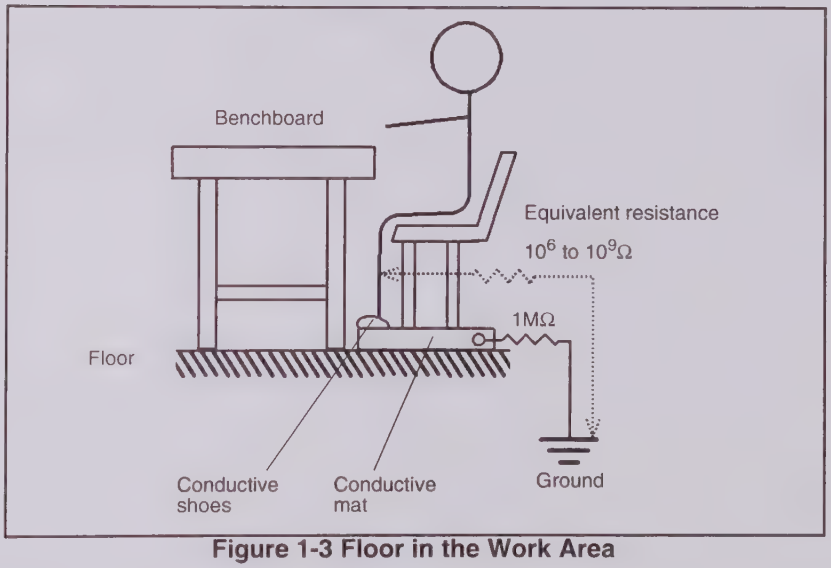


Figure 1-3 Floor in the Work Area

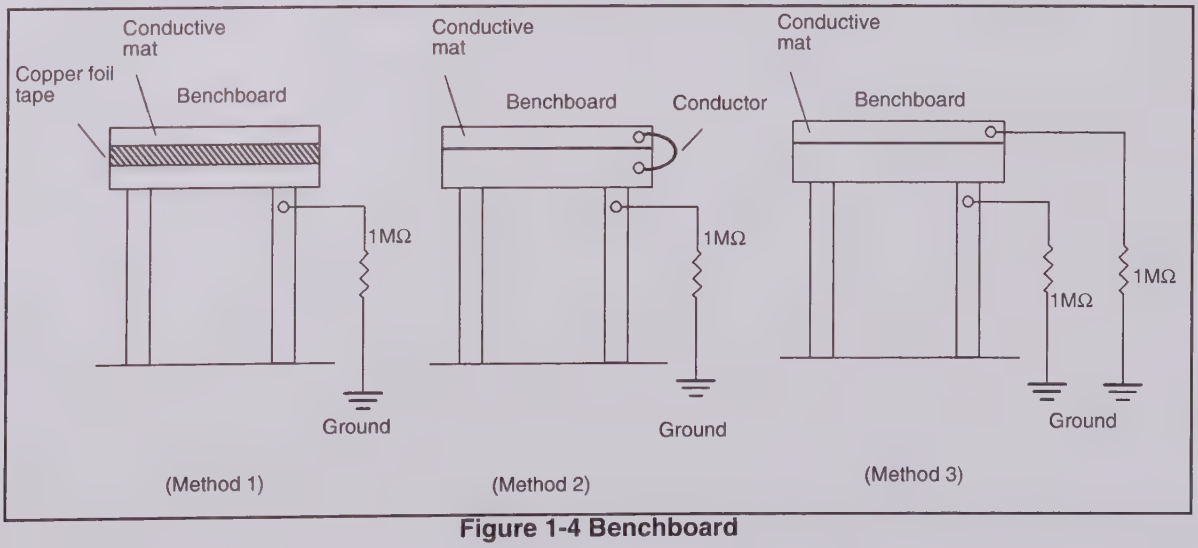


Figure 1-4 Benchboard

1.12 Calibration

This analyzer system requires yearly calibration. Calibration work should be done at an ADVANTEST CORPORATION site. Please contact ADVANTEST CORPORATION concerning the calibration.

1.13 Replacing Parts with Limited Life

The R3765/67G series uses the following parts with limited life that are not listed in Safety Summary.

Replace the parts listed below after their expected lifespan has expired.

Part name	Life
Panel key switch	500,000 times operating life (Reference value)
LCD (liquid crystal display) back light	50,000 hours operating life (Reference value)
Rotary encoder	2,500,000 operations (typical value)
RF fan	20,000 hours in operation (typical value)

2 PANEL DESCRIPTION

The names and the functions of each part on the front and rear panel side and the display screen are described.

2.1 Front Panel Descriptions

2.1.1 R3765AG/67AG

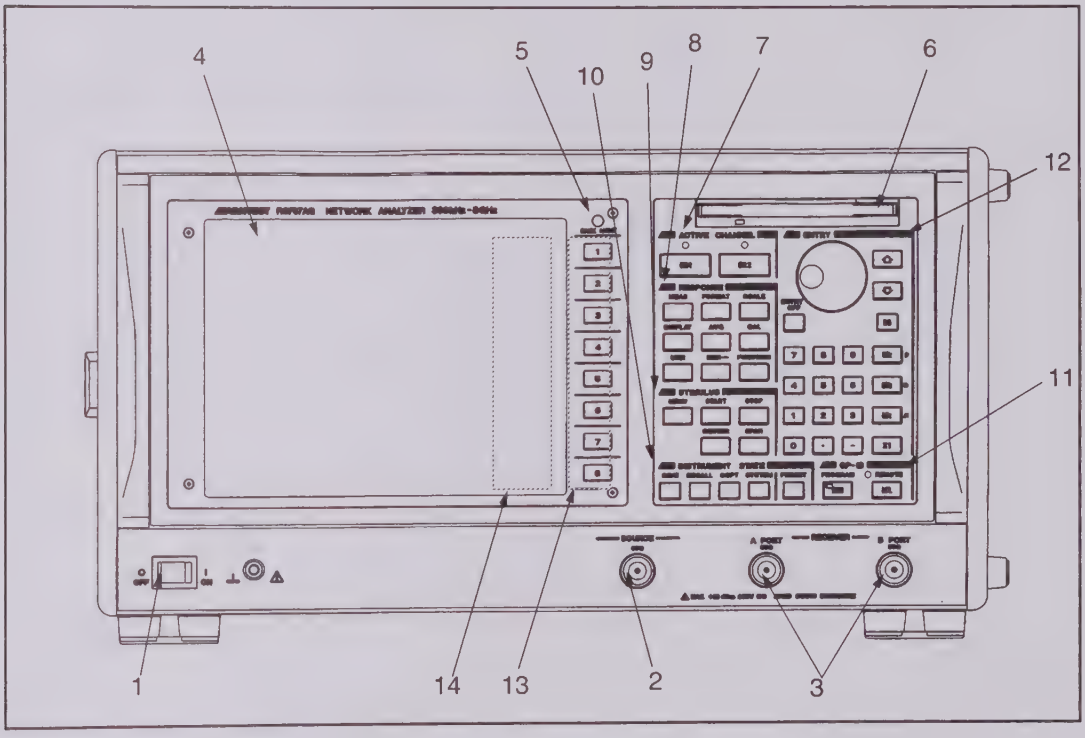


Figure 2-1 Front-Panel Descriptions (R3765AG/67AG)

Table 2-1 Front-Panel Descriptions (R3765AG/67AG)

No.	Name	Description
1	POWER switch	Turns on or off the power supply of the R3765AG/67AG.
2	SIGNAL SOURCE OUTPUT connector (SOURCE)	Power splitter output.
3	RECEIVER SECTION INPUT connector A PORT B PORT	The INPUT connector is used for measurement input.
4	LCD display	Displays measurement data, setting conditions and other informations.
5	BACK LIGHT	Selects the back light ON/OFF of LED display.
6	Floppy disk drive	Stores a program and measurement data. Three modes of storage capacity (DD: 720KB, HD: 1.2MB, HD: 1.44MB).
7	ACTIVE CHANNEL block	The ACTIVE CHANNEL block is used to select an active channel between independently two measurement channels. Each channel has a sub-measurement screen which can be selected by toggle. Sub-measurement screen of CH1 : CH3 Sub-measurement screen of CH2 : CH4 After selecting, functions to be operated are effective to the selected active channel.
8	RESPONSE block	The RESPONSE block is used to set measurement conditions of receiver section, data display and data analysis.
9	STIMULUS block	The STIMULUS block is used to set frequencies, level and sweep conditions of signal source.
10	INSTRUMENT STATE block	The INSTRUMENT STATE block is used set the system functions which have no concern with the measurement.
11	GPIB block	The GPIB block is used to set a GPIB and controller functions.
12	ENTRY block	The ENTRY block is used to input numeric data and to perform a marker movement.
13	Soft key	Selects the soft key menu described in ⑭ in each function block.
14	Soft key menu	Displays each function menu. To select a menu, use the soft key described in ⑬.

2.1.2 R3765BG/67BG

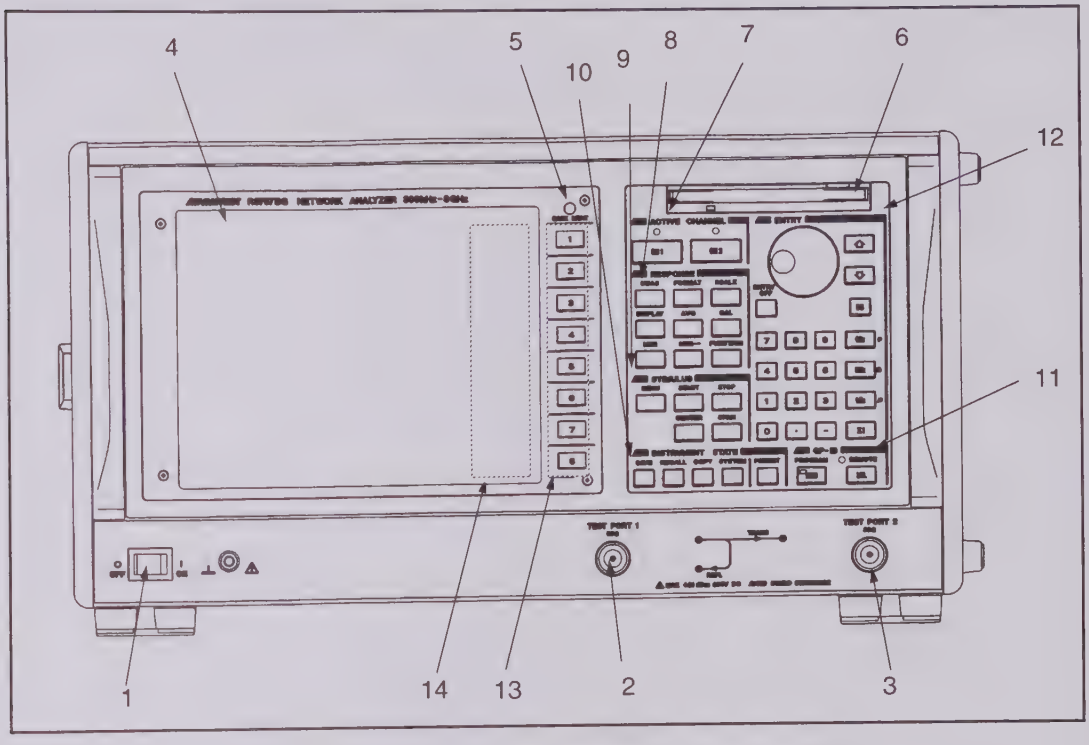


Figure 2-2 Front-Panel Descriptions (R3765BG/67BG)

Table 2-2 Front-Panel Descriptions (R3765BG/67BG)

No.	Name	Description
1	POWER switch	Turns on or off the power supply of the R3765BG/67BG.
2	Reflection characteristic connector TEST PORT 1	Reflection characteristic measurement port.
3	Transmission characteristic connector TEST PORT 2	Transmission characteristic measurement port.
4	LCD display	Displays measurement data, setting conditions and other informations.
5	BACK LIGHT	Selects the back light ON/OFF of LED display.
6	Floppy disk drive	Stores a program and measurement data. Three modes of storage capacity (DD: 720KB, HD: 1.2MB, HD: 1.44MB).
7	ACTIVE CHANNEL block	The ACTIVE CHANNEL block is used to select an active channel between independently two measurement channels. Each channel has a sub-measurement screen which can be selected by toggle. Sub-measurement screen of CH1 : CH3 Sub-measurement screen of CH2 : CH4 After selecting, functions to be operated are effective to the selected active channel.
8	RESPONSE block	The RESPONSE block is used to set measurement conditions of receiver section, data display and data analysis.
9	STIMULUS block	The STIMULUS block is used to set frequencies, level and sweep conditions of signal source.
10	INSTRUMENT STATE block	The INSTRUMENT STATE block is used set the system functions which have no concern with the measurement.
11	GPIB block	The GPIB block is used to set a GPIB and controller functions.
12	ENTRY block	The ENTRY block is used to input numeric data and to perform a marker movement.
13	Soft key	Selects the soft key menu described in ⑭ in each function block.
14	Soft key menu	Displays each function menu. To select a menu, use the soft key described in ⑬.

2.1.3 R3765CG/67CG

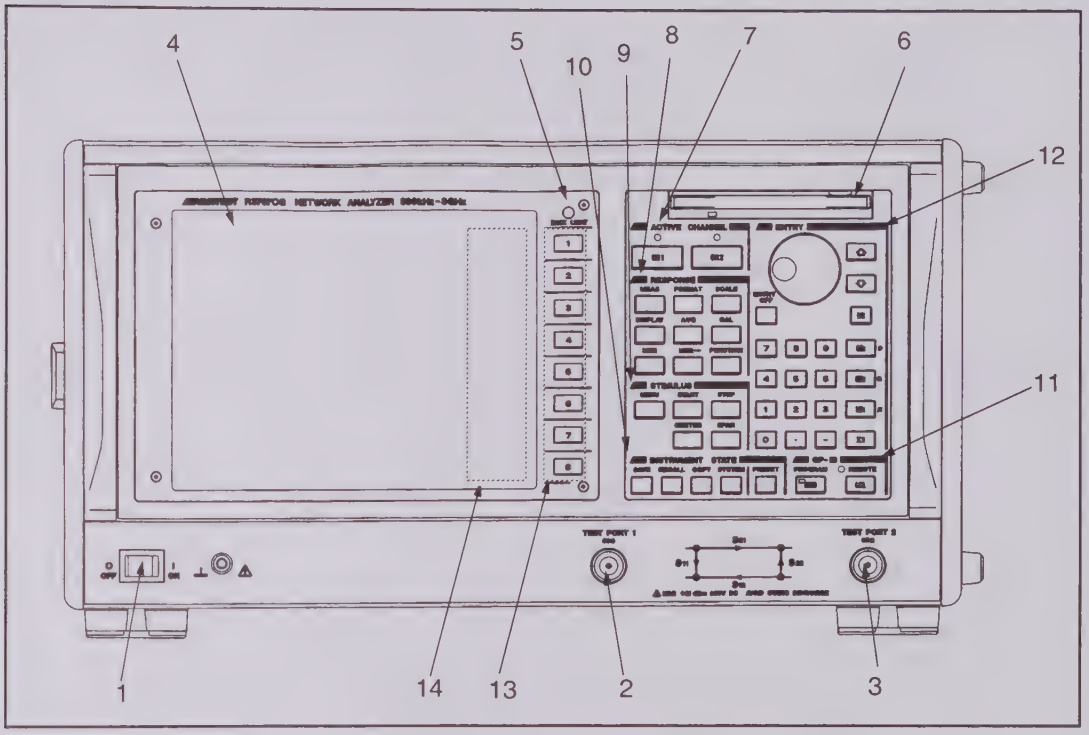


Figure 2-3 Front-Panel Descriptions (R3765CG/67CG)

Table 2-3 Front-Panel Descriptions (R3765CG/67CG)

No.	Name	Description
1	POWER switch	Turns on or off the power supply of the R3765CG/67CG.
2	PORT 1 connector TEST PORT 1	Measurement of PORT 1.
3	PORT 1 connector TEST PORT 2	Measurement of PORT 2.
4	LCD display	Displays measurement data, setting conditions and other informations.
5	BACK LIGHT	Selects the back light ON/OFF of LED display.
6	Floppy disk drive	Stores a program and measurement data. Three modes of storage capacity (DD: 720KB, HD: 1.2MB, HD: 1.44MB).
7	ACTIVE CHANNEL block	The ACTIVE CHANNEL block is used to select an active channel between independently two measurement channels. Each channel has a sub-measurement screen which can be selected by toggle. Sub-measurement screen of CH1 : CH3 Sub-measurement screen of CH2 : CH4 After selecting, functions to be operated are effective to the selected active channel.
8	RESPONSE block	The RESPONSE block is used to set measurement conditions of receiver section, data display and data analysis.
9	STIMULUS block	The STIMULUS block is used to set frequencies, level and sweep conditions of signal source.
10	INSTRUMENT STATE block	The INSTRUMENT STATE block is used set the system functions which have no concern with the measurement.
11	GPIB block	The GPIB block is used to set a GPIB and controller functions.
12	ENTRY block	The ENTRY block is used to input numeric data and to perform a marker movement.
13	Soft key	Selects the soft key menu described in ⑭ in each function block.
14	Soft key menu	Displays each function menu. To select a menu, use the soft key described in ⑬.

2.1.4 R3765CG/67CG (OPT11)

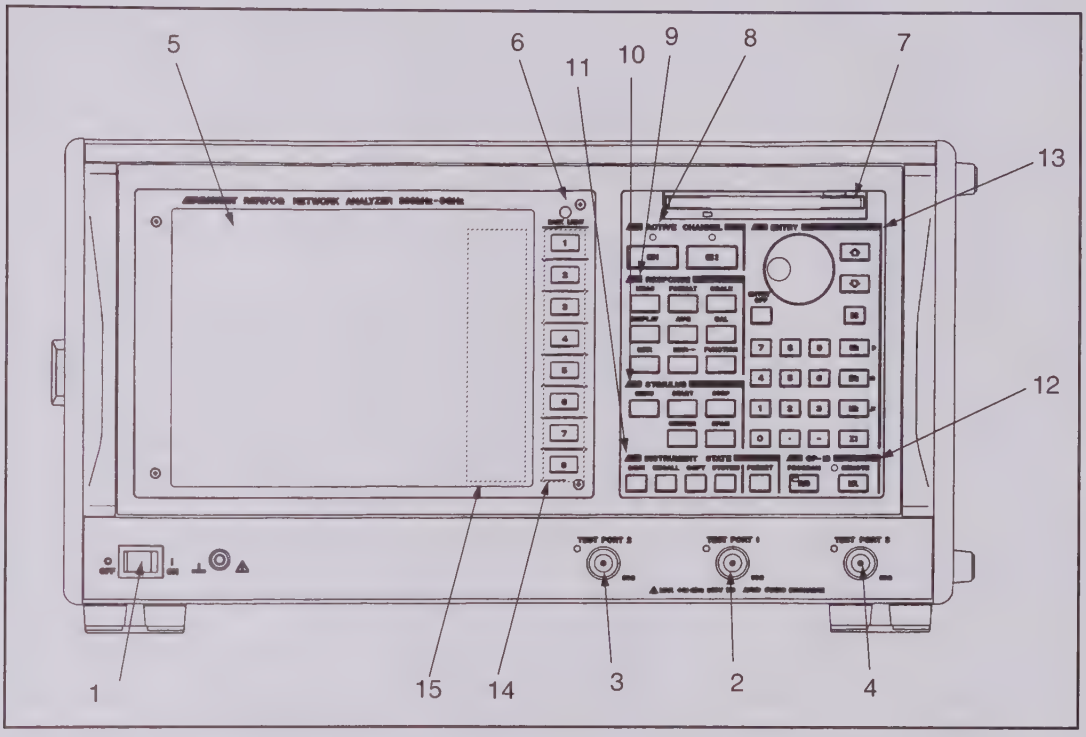


Figure 2-4 Front-Panel Descriptions (R3765CG/67CG (OPT 11))

Table 2-4 Front-Panel Descriptions (R3765CG/67CG (OPT11))

No.	Name	Description
1	POWER switch	Turns on or off the power supply of the R3765CG/67CG.
2	PORT 1 connector TEST PORT 1	Measurement of PORT 1.
3	PORT 1 connector TEST PORT 2	Measurement of PORT 2.
4	PORT 1 connector TEST PORT 3	Measurement of PORT 3.
5	LCD display	Displays measurement data, setting conditions and other informations.
6	BACK LIGHT	Selects the back light ON/OFF of LED display.
7	Floppy disk drive	Stores a program and measurement data. Three modes of storage capacity (DD: 720KB, HD: 1.2MB, HD: 1.44MB).
8	ACTIVE CHANNEL block	The ACTIVE CHANNEL block is used to select an active channel between independently two measurement channels. Each channel has a sub-measurement screen which can be selected by toggle. Sub-measurement screen of CH1 : CH3 Sub-measurement screen of CH2 : CH4 After selecting, functions to be operated are effective to the selected active channel.
9	RESPONSE block	The RESPONSE block is used to set measurement conditions of receiver section, data display and data analysis.
10	STIMULUS block	The STIMULUS block is used to set frequencies, level and sweep conditions of signal source.
11	INSTRUMENT STATE block	The INSTRUMENT STATE block is used set the system functions which have no concern with the measurement.
12	GPIB block	The GPIB block is used to set a GPIB and controller functions.
13	ENTRY block	The ENTRY block is used to input numeric data and to perform a marker movement.
14	Soft key	Selects the soft key menu described in ⑮ in each function block.
15	Soft key menu	Displays each function menu. To select a menu, use the soft key described in ⑭.

2.1.5 R3765CG/67CG (OPT14)

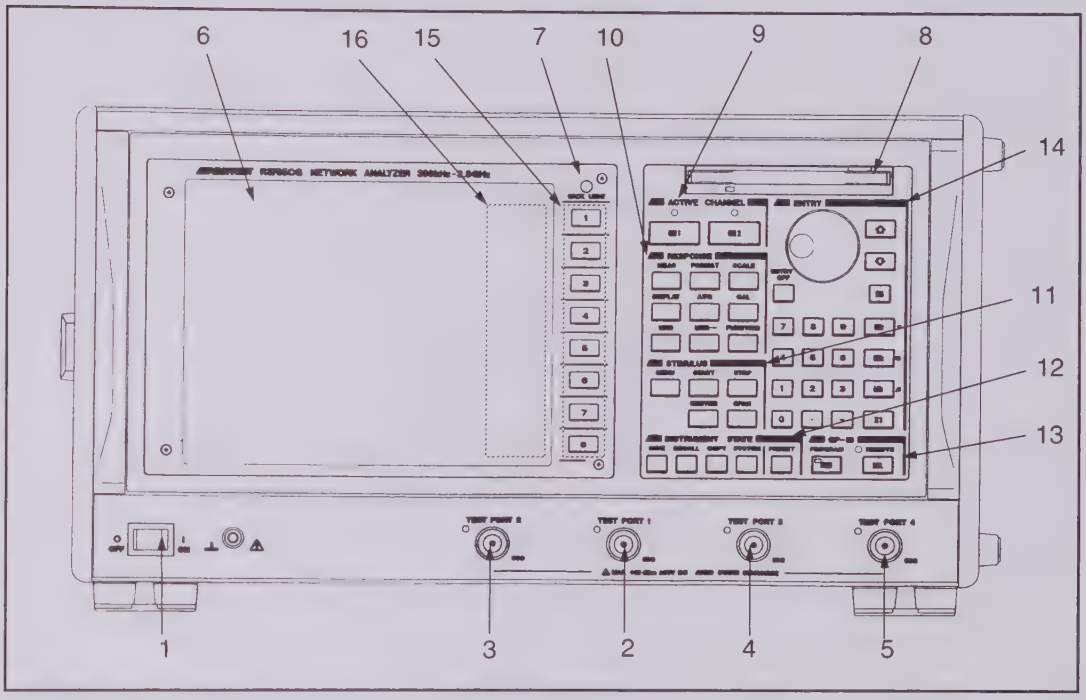


Figure 2-5 Front-Panel Descriptions (R3765CG/67CG (OPT 14))

Table 2-5 Front-Panel Descriptions (R3765CG/67CG (OPT14))

No.	Name	Description
1	POWER switch	Turns on or off the power supply of the R3765CG/67CG.
2	PORT 1 connector TEST PORT 1	Measurement of PORT 1.
3	PORT 1 connector TEST PORT 2	Measurement of PORT 2.
4	PORT 1 connector TEST PORT 3	Measurement of PORT 3.
5	PORT 1 connector TEST PORT 4	Measurement of PORT 4.
6	LCD display	Displays measurement data, setting conditions and other informations.
7	BACK LIGHT	Selects the back light ON/OFF of LED display.
8	Floppy disk drive	Stores a program and measurement data. Three modes of storage capacity (DD: 720KB, HD: 1.2MB, HD: 1.44MB).
9	ACTIVE CHANNEL block	The ACTIVE CHANNEL block is used to select an active channel between independently two measurement channels. Each channel has a sub-measurement screen which can be selected by toggle. Sub-measurement screen of CH1 : CH3 Sub-measurement screen of CH2 : CH4 After selecting, functions to be operated are effective to the selected active channel.
10	RESPONSE block	The RESPONSE block is used to set measurement conditions of receiver section, data display and data analysis.
11	STIMULUS block	The STIMULUS block is used to set frequencies, level and sweep conditions of signal source.
12	INSTRUMENT STATE block	The INSTRUMENT STATE block is used set the system functions which have no concern with the measurement.
13	GPIB block	The GPIB block is used to set a GPIB and controller functions.
14	ENTRY block	The ENTRY block is used to input numeric data and to perform a marker movement.
15	Soft key	Selects the soft key menu described in ⑮ in each function block.
16	Soft key menu	Displays each function menu. To select a menu, use the soft key described in ⑭.

2.2 Rear Panel Descriptions

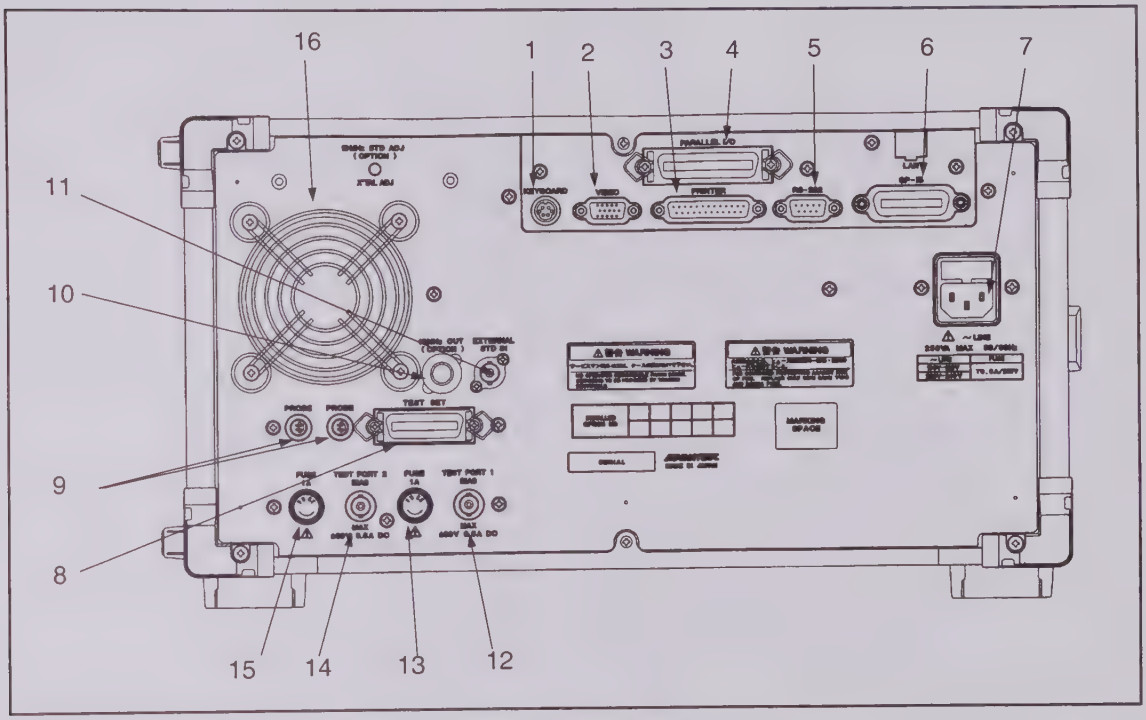


Figure 2-6 Rear Panel Descriptions

Table 2-6 Rear Panel Descriptions (R3765CG/67CG)

No.	Name	Description
1	KEYBOARD connector	Connector to connect PS/2 type (6-pin small size DIN) key board. An external keyboard can be used to input a label name, a saving register name and a BASIC text.
2	VIDEO connector	Video signal output correspondence to VGA. (15-pin)
3	PRINTER connector	
4	PARALLEL I/O connector	The I/O port connector is used to communicate peripheral devices such as an automatic machine and a foot switch. (Output: 8-bit 2 systems, Input/output: 4-bit 2 systems) EXT TRIGGER input. (Negative logic, pulse width: 1μs or more, 18-pin terminal) *Use shielded cables for connection (to prevent malfunction by noise).
5	RS-232 connector	Input/output connector conformed to RS-232 standard. (D Sub 9-pin male)
6	GP-IB connector	The GPIB connector is used to remotely control an external peripheral devices and to be remotely controlled by an external controller.
7	AC POWER connector	The AC POWER connector has three-pin structure includes an earth pin. To remove a power fuse, pull out the upper cover.
8	TEST SET connector	Connector (used with the AG or CG model) for the test-set
9	PROBE connector	Connector for probe power. ±12V output
10	10MHz OUT (OPTION) connector	Spare connector for option.
11	External STD IN connector	This connector is used to input a reference frequency from an external device. Input frequency : 1, 2, 5, 10MHz, 0dBm or more Input frequency accuracy : Within ±10ppm
12	TEST PORT 1 BIAS	Connector used for the bias input to TEST PORT 1. (MAX.±30V 0.5A DC) (For the CG model only, excluding CG model analyzers with OPT 11, 13 or 14 installed)
13	Fuse holder	Fuse (1A) for the bias input to TEST PORT 1. (For the CG model only, excluding CG model analyzers with OPT 11, 13 or 14 installed)
14	TEST PORT 2 BIAS	Connector used for the bias input to TEST PORT 2. (MAX.±30V 0.5A DC) (For the CG model only, excluding CG model analyzers with OPT 11, 13 or 14 installed)
15	Fuse holder	Fuse (1A) for the bias input to TEST PORT 2. (For the CG model only, excluding CG model analyzers with OPT 11, 13 or 14 installed)
16	Exhaust vent	Cooling fan. ***CAUTION! Do not block the vent.***

2.3 Screen Display Descriptions

The following shows R3767CG screen. Each part is described in the next page.

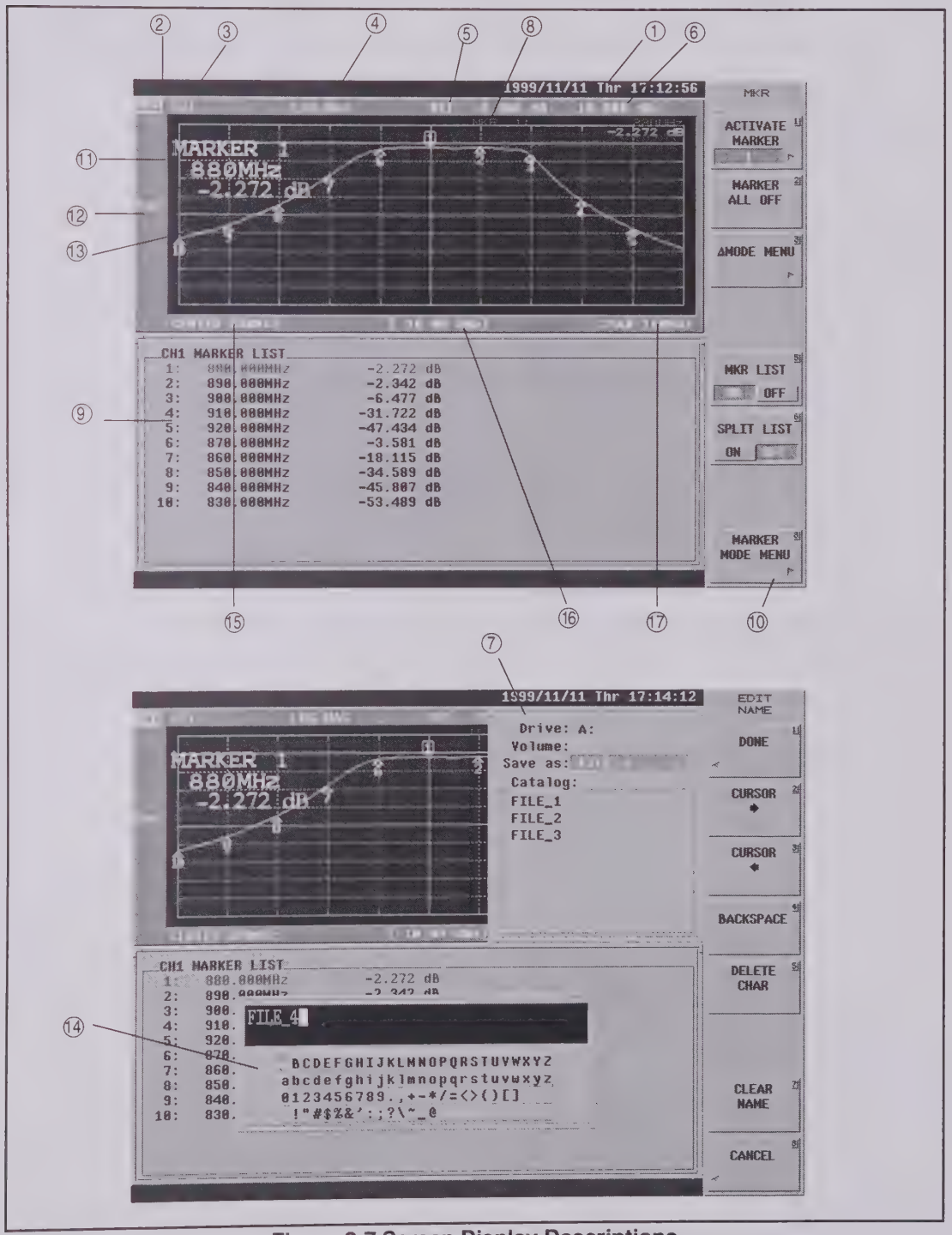


Figure 2-7 Screen Display Descriptions

Table 2-7 Screen Display Descriptions

No.	Name	Description
①	Real time clock	Displays the year, month, day, day of the week and time.
②	Channel	Displays a channel number.
③	Measured parameter	Displays the measured parameter.
④	Format	Displays data format (format data).
⑤	Scale reference	Displays a reference value of display coordinate. The reference position is displayed by using 'mark.
⑥	Scale/DIV	Displays one scale value of display coordinate.
⑦	Load menu	Displays files in this area when loading program from the disk drive.
⑧	Active marker	Displays an active marker value.
⑨	Marker list	Displays a marker list.
⑩	Soft key menu	Displays a soft key menu.
⑪	Active area	Displays items selected by panel keys or soft keys and those input values.
⑫	Status area	Displays status which shows an operating state of the R3765/67H series.
⑬	Trace display area	Displays measurement data.
⑭	Label window	Displays character lists used for a label and a register name.
⑮	Start/Center	Displays the start/center of signal source.
⑯	Power/CW	Displays the power/CW of signal source.
⑰	Stop/Span	Displays the stop/span of signal source.

3 BASIC OPERATING GUIDELINES

This chapter explains the fundamental operation for those who use the R3765/67G series for the first time.

3.1 Initial Power-on

(1) Connecting to AC Power Source

① With the R3765/67G's power switch turned OFF, connect the attached power cable to the AC power connector on the rear panel.

CAUTION!
To avoid damage to the analyzer, operate the analyzer within the specified input voltage and frequency ranges.

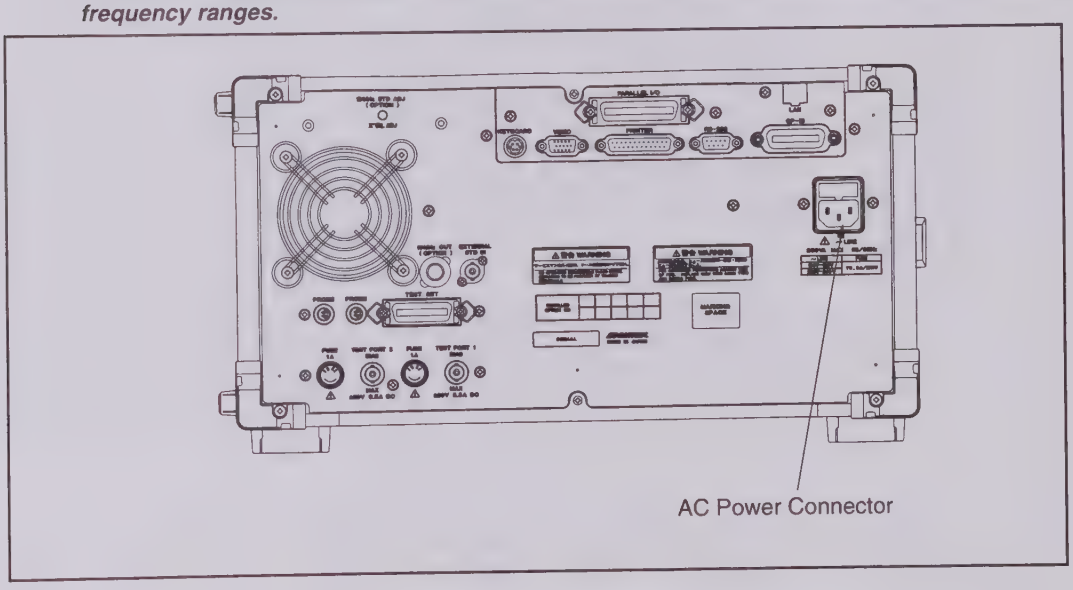


Figure 3-1 Connecting the Power Cable

② Connect end of the power cable to an outlet.

(2) Power-on

After connecting the power cable, turn ON the power switch on the front panel.

- Turn the power switch ON.
  The initial setting screen is displayed approximately 30 seconds after the initial self-checking is complete.

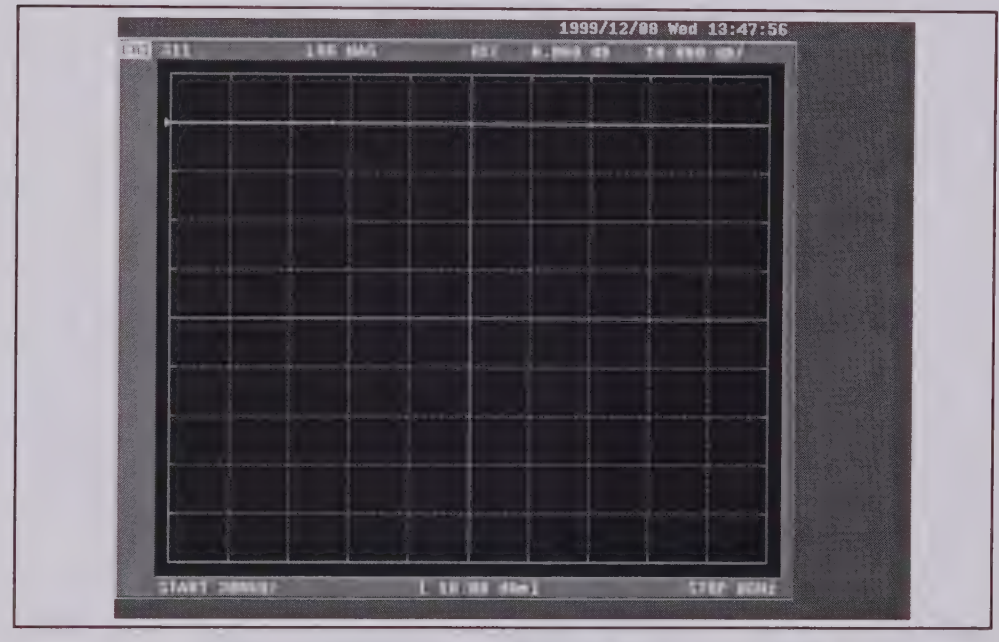


Figure 3-2 Setting Screen When Switch on or Preset

At power-on, the initial setting screen is displayed as shown above.
When the initial setting screen is needed to display, press **[PRESET]** key.

3.2 Operation Keys

3.2.1 Panel Keys and Soft Keys

This R3765/67G series is operated with **[panel keys]** and *{soft keys}*.

[ ] is panel key. *{ }* is soft key.

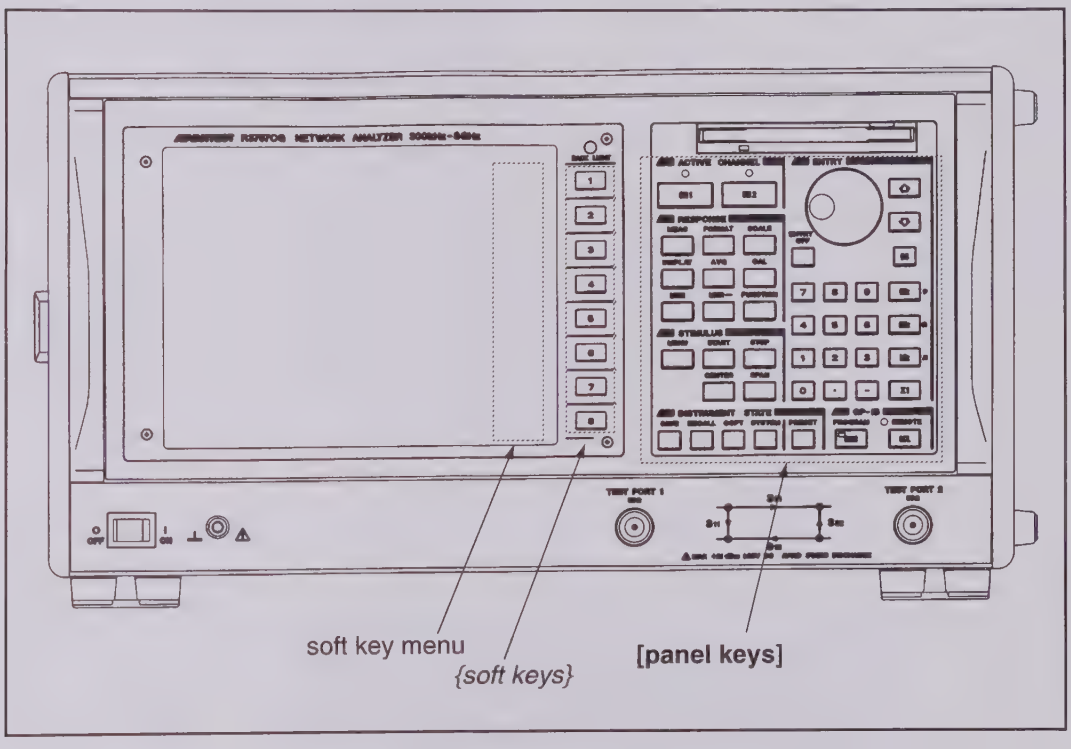


Figure 3-3 Panel Keys and Soft Keys

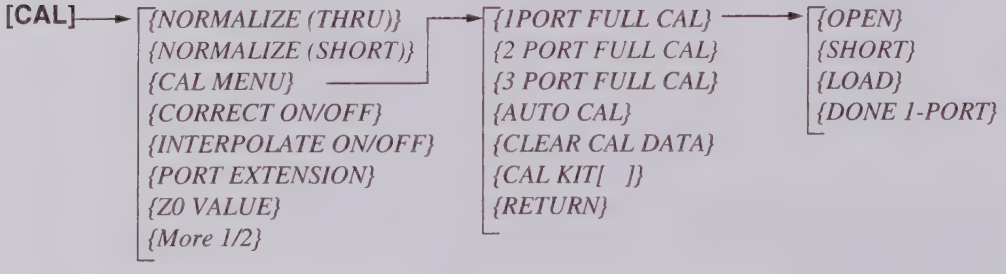
Pressing a **[panel key]** displays a soft key menu at right on the screen.

Press a *{soft key}* and the corresponding function in the soft key menu will be displayed.

(1) The panel keys are parted into 6 function blocks shown below.
The operation is performed with the combination of these blocks.

Block name		Function
①	ACTIVE CHANNEL	The R3765/67G series has two measurement channels. Select an active channel which can be set and changed.
②	ENTRY	Input the numeric value for the selected function.
③	STIMULUS	Sets the conditions of signal source such as frequency range, power level, sweep type sweep time and sweep resolution.
④	RESPONSE	Sets measurement conditions of receiver part, measurement parameter, measurement format and display format marker for the active channel.
⑤	INSTRUMENT STATE	Sets the system such as save/recall or hard copy.
⑥	GPIB	Sets controller function and GPIB.

(2) Press panel key **[CAL]** in RESPONSE block.
Calibration menu appears on the screen. (Refer to section A.4 at the end of this manual.)
Soft menus shown below are displayed on the right portion of the display.



The soft key corresponding to the blank soft key menu is invalid.
Some soft key menu has more than one page, and some has hierarchy.

- When the soft key menu has more than one page
  Pressing *{More 1/2}* moves the page to the next.
  Pressing *{More 2/2}* returns the page to the previous.
- When the soft key menu has hierarchy
  Pressing *{Return}* returns to the previous hierarchy menu.
- When the menu is of hierarchy of calibration data acquisition
  In the case that more than one data acquisition is required for the calibration like 1 port full calibration.
  Pressing *{DONE 1-PORT}* without acquiring each data can return to the previous hierarchy menu forcefully.

  In order to move it to the top menu from the middle of a series of soft key menu, press **[CAL]** key if the menu is of CAL. Ditto for others.
  For example, pressing **[MENU]** key to invoke soft key menu of MENU from the situation that the soft key menu of CAL is displayed, and continuously pressing **[CAL]** key redisplays the same CAL soft key menu as the one before **[MENU]** key pressed.

(3) Data setting

When a **[panel key]** and a *{soft key}* is pressed to set data, the function of the pressed key and the current set conditions are displayed at upper left on the screen.
This display area is called "active area". Set data, checking the values displayed in the active area.

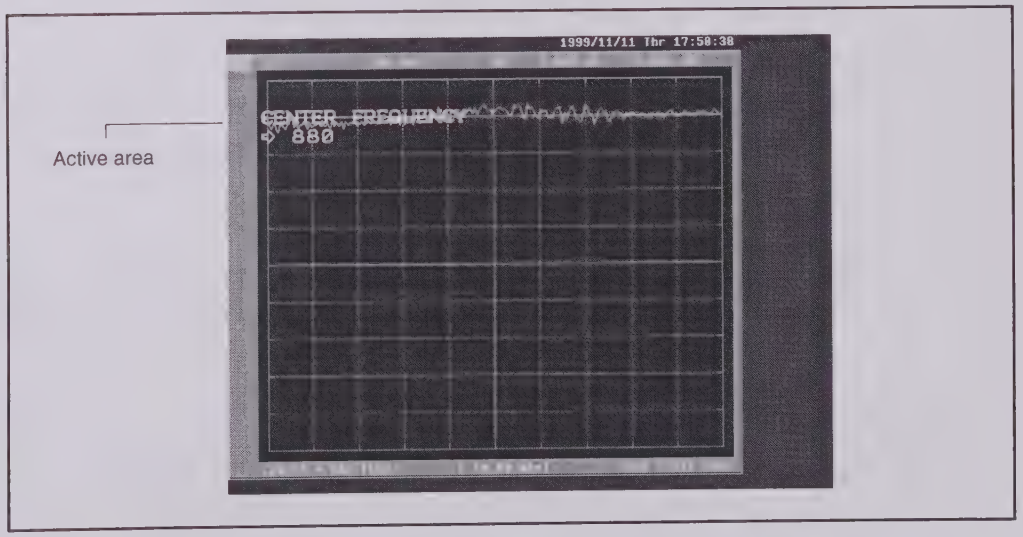


Figure 3-4 Displayed Active Area

There are 3 methods for setting data.

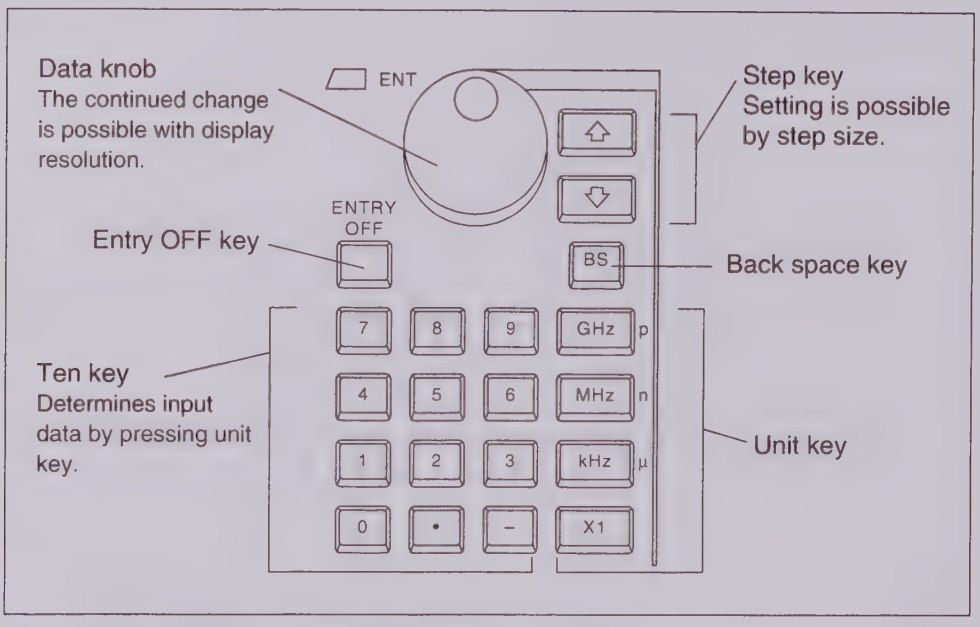


Figure 3-5 How to Set Data

- Ten-key and unit key

  These keys are used to input numeric data.

  Input a numeric value with ten-key, and press a unit key.

  Pressing **[BS]** key deletes the rightmost digit of the numeric value which has been input with ten-key.

- Step key and data knob

  Step key is used to set data by predefined step size.

  Pressing [↑] key increments the data, while pressing [↓] key decrements the data.

  Data knob is used to set data in units of predefined display resolution. It is very convenient for finely adjusting set data.

- Entry off key

  Entry off key is operated by toggle.
  Sets OFF the current entry data which is displayed in active area.

  Press this key to avoid changing the entry data by actuating the knob by mistake. Then, the marker can be moved by data knob.

  Pressing the entry off key again can switch the entry OFF to ON.
  But when the preset key is pressed or when the R3765/67G series is turned OFF automatically, the entry off key cannot be switched to ON again.

  If this function is selected before plotting, the screen cleaned the active area can be plotted.

3.3 How to Read the Display Screen

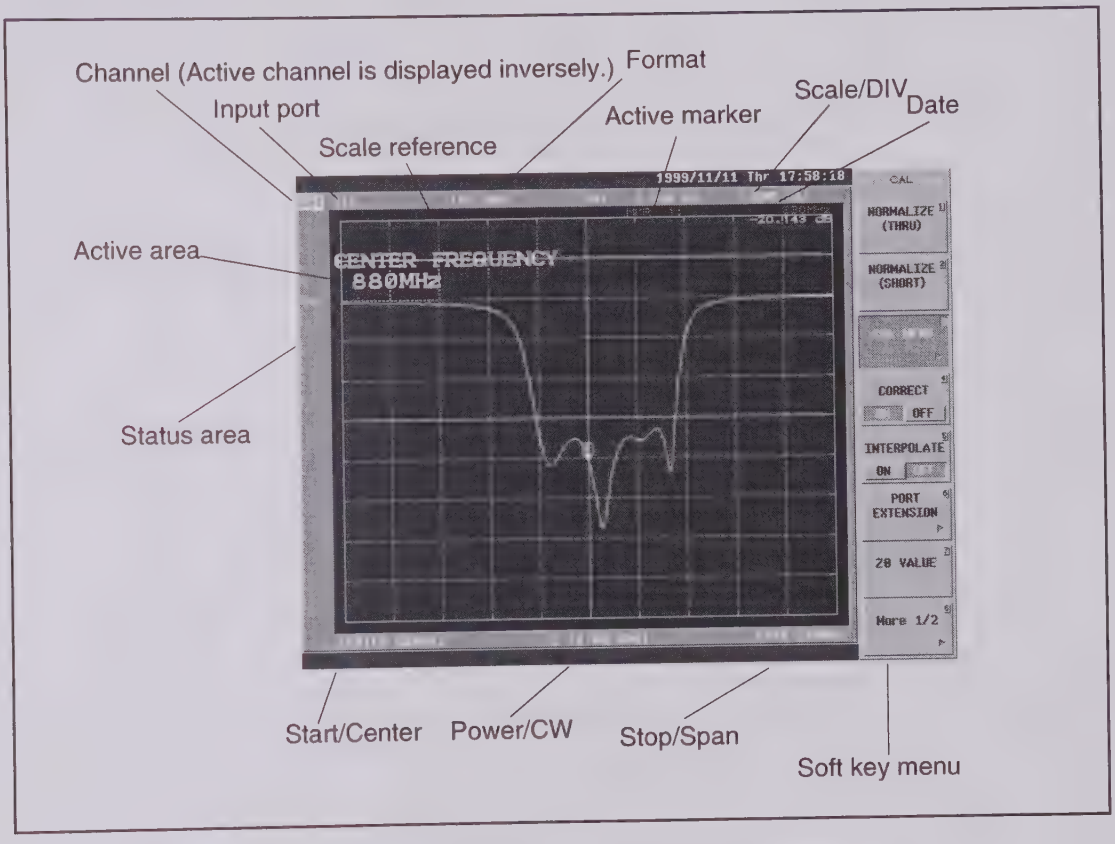


Figure 3-6 Annotation on the Screen (Annotation Character)

3.4 Basic Measuring Procedure

Shows basic measuring procedure of R3765/67G series.

Measuring procedure

① Connection

Connect DUT (device under test) to the R3765/67G series.

② Setting of the R3765/67G series

Initialize the R3765/67G series by pressing **[PRESET]** key.

Next, select the setting of the R3765/67G series according to the measurement to perform.
(If necessary, connect DUT temporarily then.)

③ Calibration

Acquire the reference of magnitude and phase according to the measurement and eliminate measurement error.

④ Measurement

Connect DUT and execute the measurement.

Read the parameter to measure by using marker function, etc.

⑤ Measured result output

The measured results can be output to the printer or the plotter with GPIB interface.

Also they can be saved in floppy disk.

3.5 Measurement Samples of Simple Transmission Characteristics

3.5.1 Setup and Setting

The setup of the R3765/67G series is performed as shown in Figure 3-7 or Figure 3-8 according to the type.

Note: ***R3765/67G SERIES cannot be connected to R396X SERIES S parameter test set.***

(1) AG type

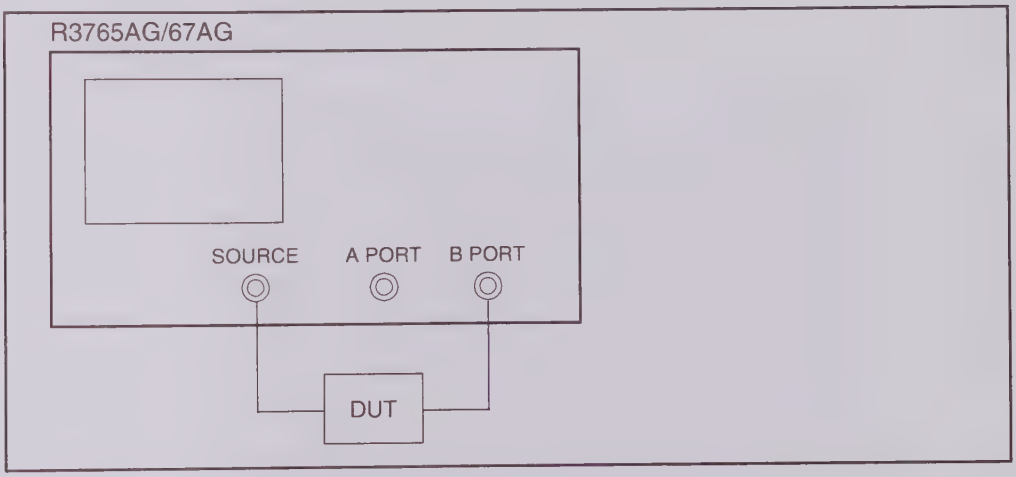


Figure 3-7 The Setup of Transmission Characteristic Measurement (AG Type)

(2) BG/CG type

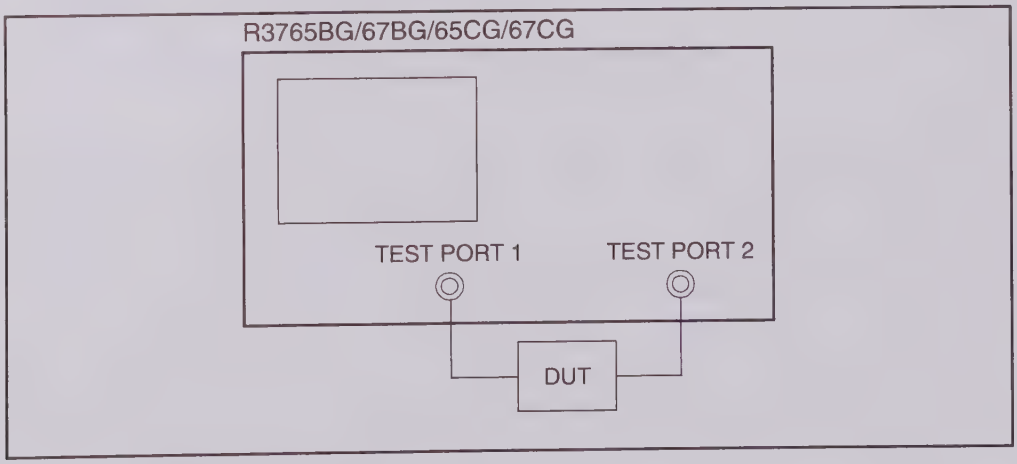


Figure 3-8 The Setup of Transmission Characteristic Measurement (BG/CG Type)

- DUT to use for the measurement sample is the band-pass filter of center frequency 880MHz.
- All the screen displays used here are display samples of R3767CG.

The displayed contents of input port in the upper left portion of the screen are different depending on the model.
The display of each type is as follows. (Active channel: CH2).

AG type	BG type	CG type
B/R	TRN	S21

TRN : TRANSMISSION

(3) Setting

① Press **[PRESET]** to preset.

② Set the R3765/67G series as follows.

Block name	Setting	Key operation
ACTIVE CHANNEL	Set the channel to 2.	**[CH 2]**
RESPONSE	Select the input port in the receiver part.	AG type : **[MEAS]** →*{B/R}* (Initial setup) BG type : **[MEAS]** →*{TRANSMISSION}* (Initial setup) CG type : **[MEAS]** →*{S21 TRANS FWD}* (Initial setup)
	Set the measurement format to magnitude (log display).	**[FORMAT]** →*{LOG MAG}* (Initial setup)
STIMULUS	Center frequency 880MHz Span frequency 100MHz	**[CENTER]** → **[8]** → **[8]** → **[0]** →**[MHz]** **[SPAN]** → **[1]** → **[0]** → **[0]** →**[MHz]**

Note: OPT11 or OPT14 uses a different [MEAS] menu.
For more information, refer to the description on page 7-10.

3.5.2 Calibration (Normalize)

Calibrate the frequency characteristics of the R3765/67G series.

① Remove DUT and connect a through adapter instead.

② Press **[CAL]** → *{NORMALIZE (THRU)}*.
The display on the screen changes as follows.
CORRECT key is set to ON automatically.

③ Following the completion, return the connection the DUT (filter).

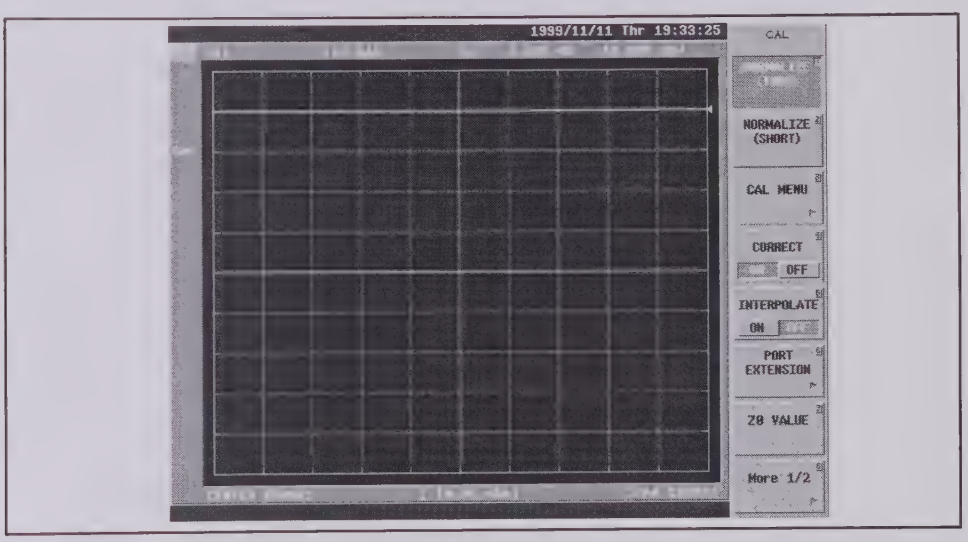


Figure 3-9 Screen of Frequency Characteristic Normalize

3.5.3 Magnitude measurement

① Adjust the scale to see the display trace easily.

[SCALE] → *{AUTO SCALE}*

The display on the screen is as follows.

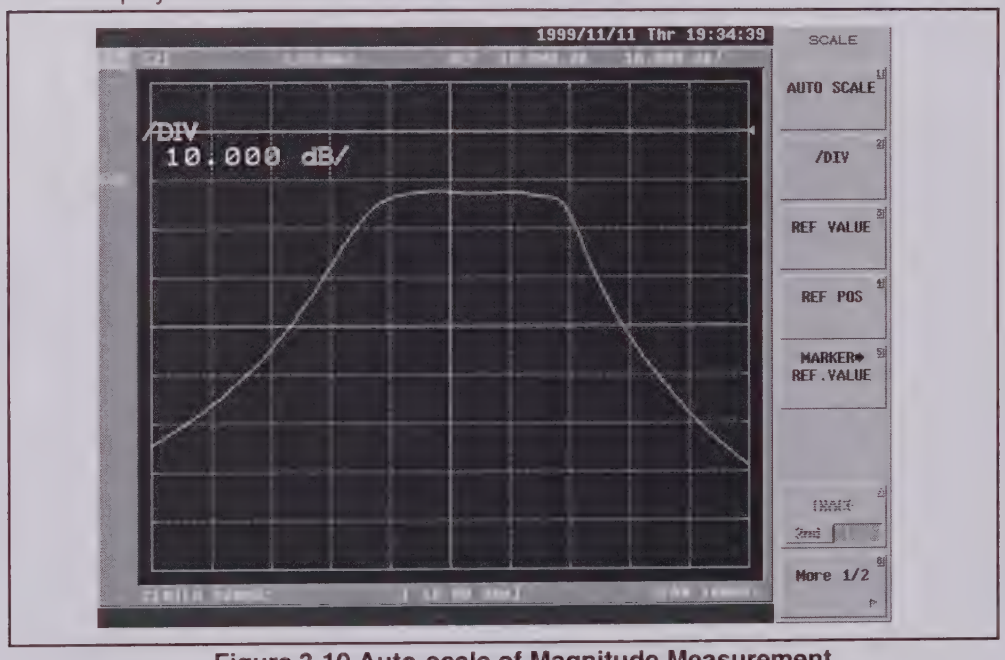


Figure 3-10 Auto-scale of Magnitude Measurement

② A measurement sample of 3dB bandwidth

Set the marker and activate the filter analysis function.

[MKR→] → *{MKR SEARCH [ ]}* → *{FLTR ANA}* → *{FLTR ANA ON/OFF}*

The display on the screen is as follows.

Bandwidth is displayed with arrow (↑) on the trace and the analyzed results are displayed.

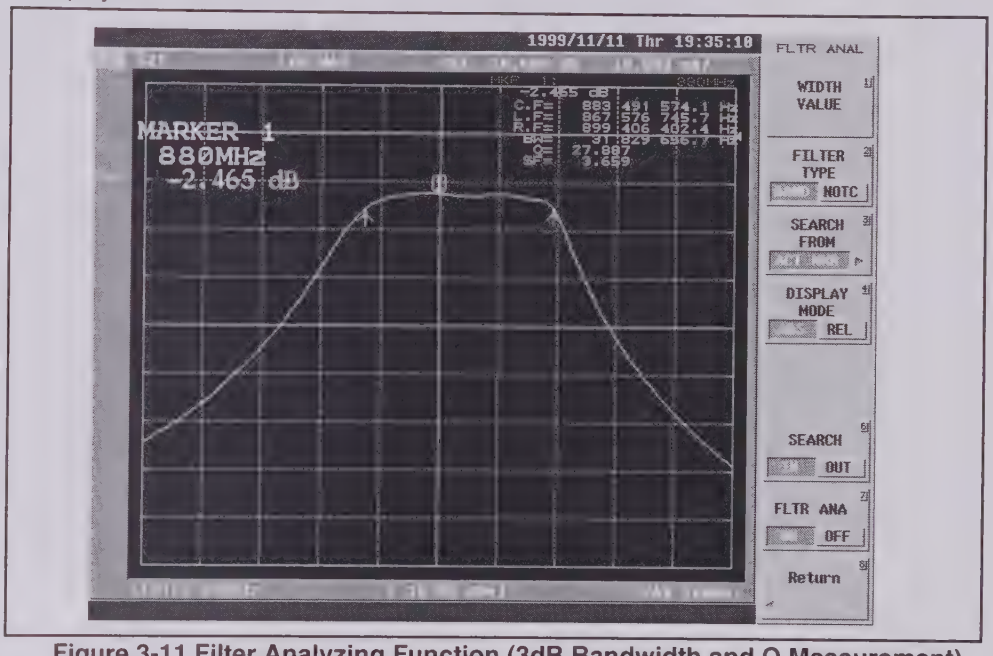


Figure 3-11 Filter Analyzing Function (3dB Bandwidth and Q Measurement)

③ A measurement sample of 6dB bandwidth

Change WIDTH VALUE (bandwidth to search) from 3dB (initial value) to 6dB.
Press *{WIDTH VALUE}* → **[6]** → **[X1]**

The display on the screen is as follows.

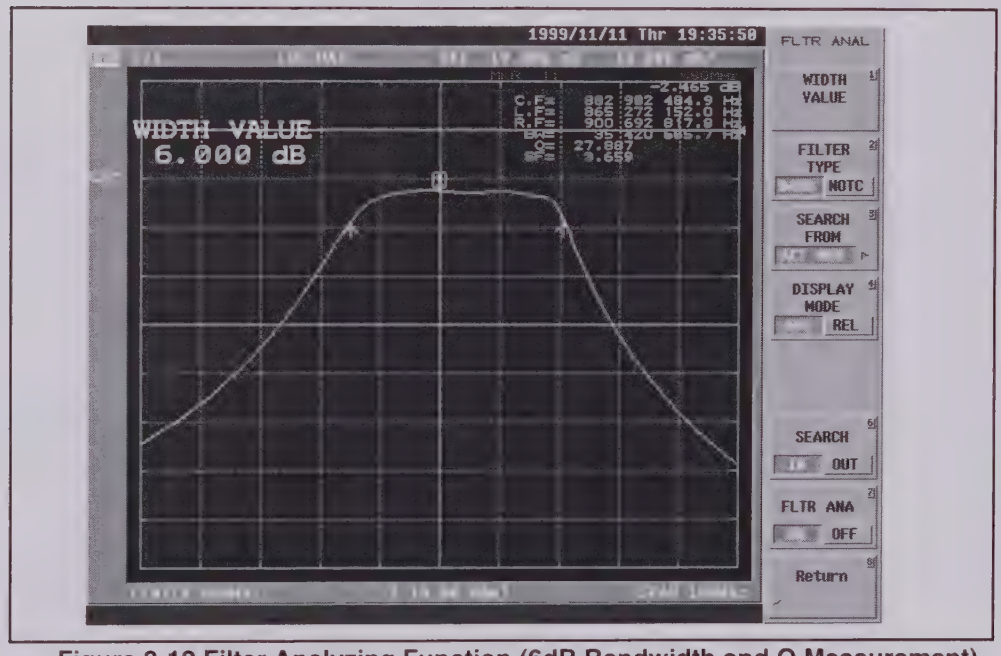


Figure 3-12 Filter Analyzing Function (6dB Bandwidth and Q Measurement)

3.5.4 Phase measurement

① Setup (refer to sub-section 3.5.1) and preset (refer to sub-section 4.4.1).

② Set the R3765/67G series as follows.

The measurement here is performed with the span lessened and inside of the bandwidth extended.

Block name	Setting	Key operation
ACTIVE CHANNEL	Set the channel to 2.	**[CH 2]**
RESPONSE	Select the input port in the receiver part.	AG type : **[MEAS]** → *{B/R}* (Initial setup) BG type : **[MEAS]** → *{TRANSMISSION}* (Initial setup) CG type : **[MEAS]** → *{S21 TRANS FWD}* (Initial setup)
	Set the measurement format to phase display.	**[FORMAT]**→ *{PHASE}*
STIMULUS	Center frequency 880MHz Span frequency 50MHz	**[CENTER]** → **[8]** → **[8]** → **[0]** → **[MHz]** **[SPAN]** → **[5]** → **[0]** → **[MHz]**

③ Calibrate (Normalize) frequency characteristics. (The same operation as sub-section 3.5.2.)

Note: OPT11 or OPT14 uses a different [MEAS] menu.
For more information, refer to the description on page 7-10.

④ Adjust the scale to see the display trace easily.
Pressing **[SCALE]** → *{AUTO SCALE}* shows the following display on the screen.

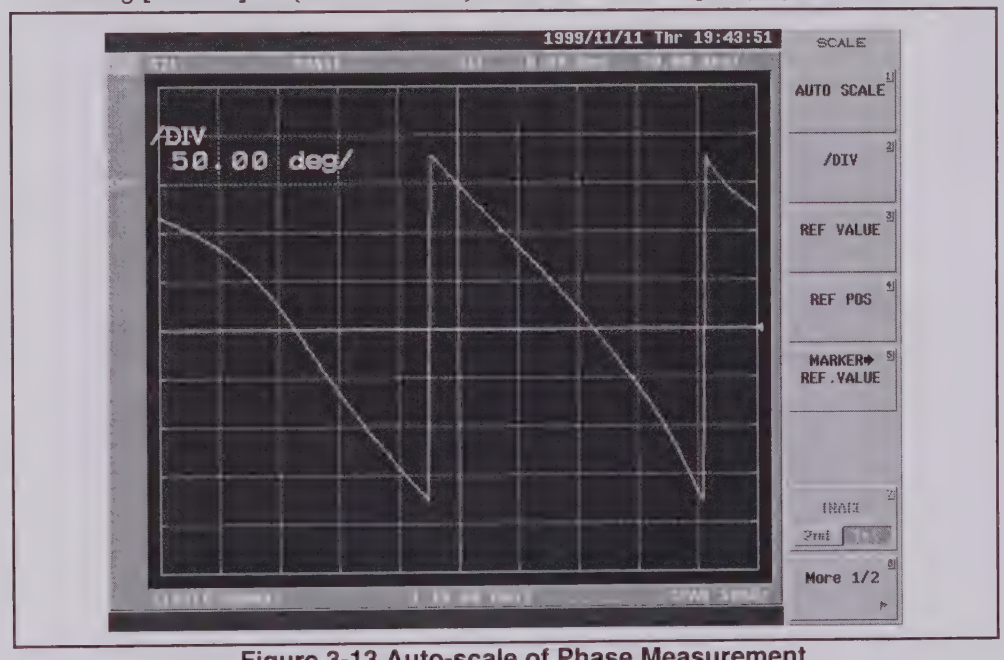


Figure 3-13 Auto-scale of Phase Measurement

⑤ Set the phase extension display.

[FORMAT] → *{More 1/2}* → *{PHASE -∞, +∞}*

[SCALE] → *{AUTO SCALE}*

The display on the screen is as follows.

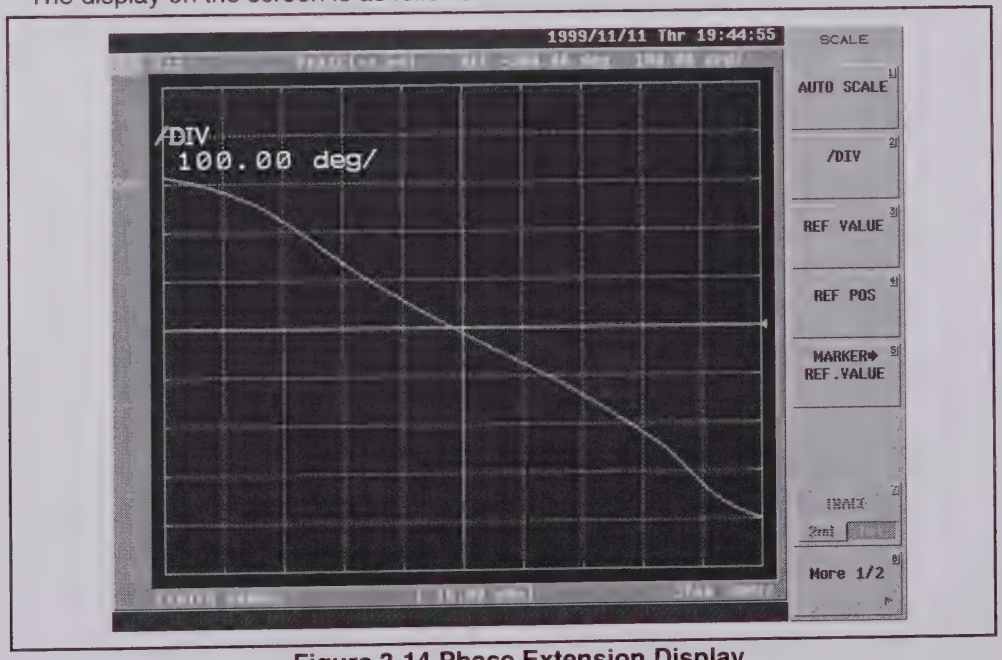


Figure 3-14 Phase Extension Display

3.5.5 Group delay measurement

① Setup (refer to sub-section 3.5.1) and preset (refer to sub-section 4.4.1).

② Set the R3765/67G series as follows.

The measurement here is performed with the span lessened and inside of the bandwidth extended.

Block name	Setting	Key operation
ACTIVE CHANNEL	Set the channel to 2.	**[CH 2]**
RESPONSE	Select the input port in the receiver part.	AG type : **[MEAS]** → *{B/R}* (Initial setup) BG type : **[MEAS]** → *{TRANSMISSION}* (Initial setup) CG type : **[MEAS]** → *{S21 TRANS FWD}* (Initial setup)
	Set the measurement format to group delay display.	**[FORMAT]** → *{DELAY}*
STIMULUS	Center frequency 880MHz Span frequency 50MHz	**[CENTER]** → **[8]** → **[8]** → **[0]** → **[MHz]** **[SPAN]** → **[5]** → **[0]** → **[MHz]**

③ Calibrate frequency characteristics. (The same operation as sub-section 3.5.2.)

Note: OPT11 or OPT14 uses a different [MEAS] menu.
For more information, refer to the description on page 7-10.

④ Adjust the scale to see the display trace easily.

Pressing **[SCALE]** → *{AUTO SCALE}* shows the following display on the screen.

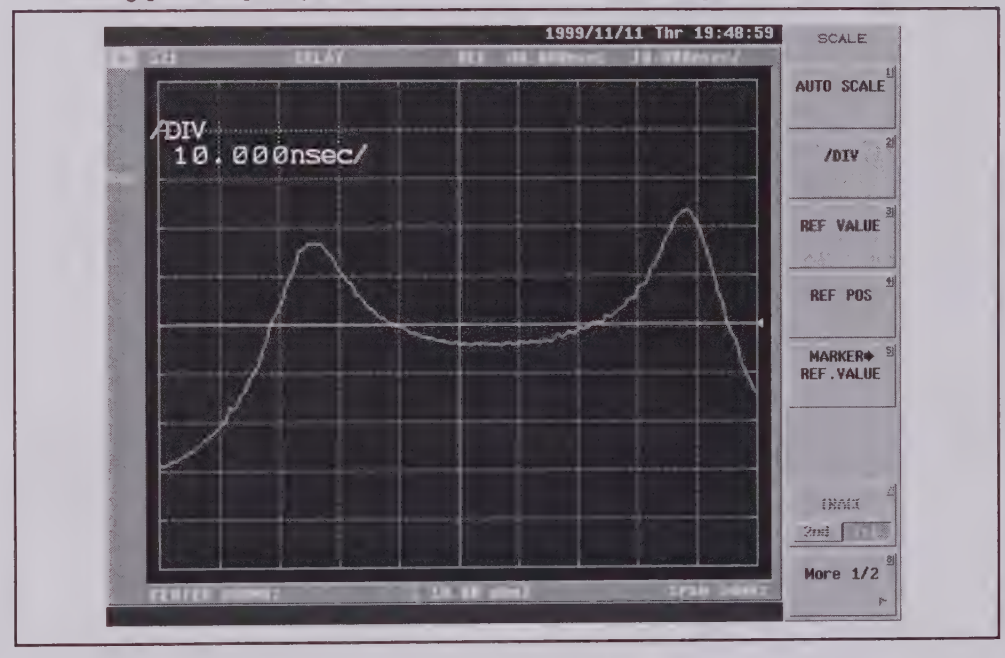


Figure 3-15 Auto-scale of Group Delay Measurement

⑤ Change group delay aperture to 20%.

[AVG] → *{GROUP DELAY APERTURE}* → **[2]**→ **[0]** → **[X1]**

The display on the screen is as follows.

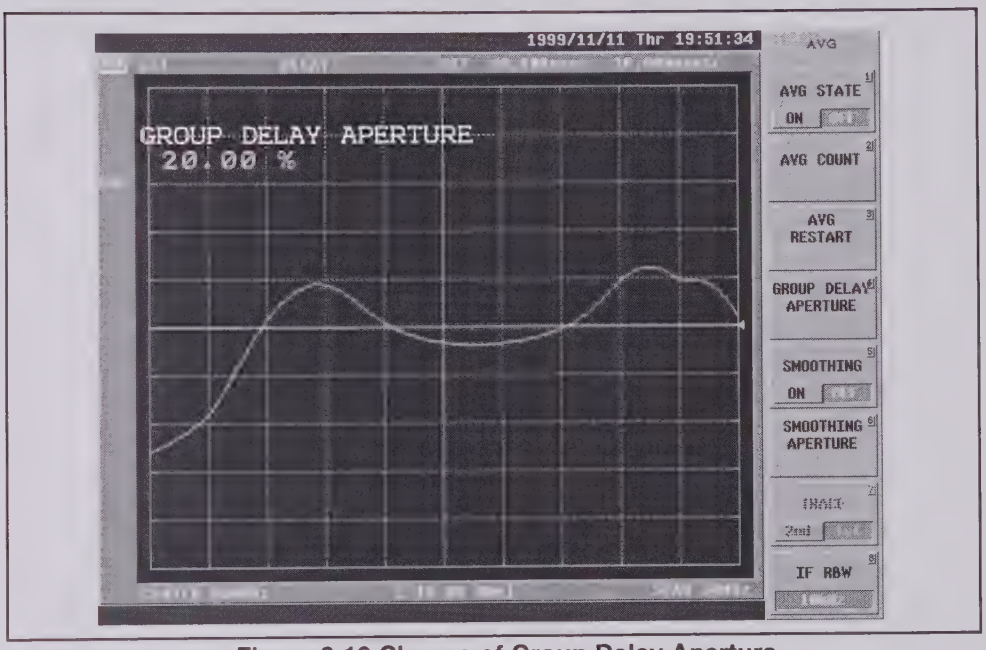


Figure 3-16 Change of Group Delay Aperture

3.6 Measurement Samples of Simple Reflection Characteristics

3.6.1 Setup

The R3765/67G series is setup as shown in Figure 3-17 and Figure 3-18.

(1) AG type

In order to measure the reflection characteristics with AG type, directive bridge to separate reflection wave and incident wave from DUT to measure are necessary.

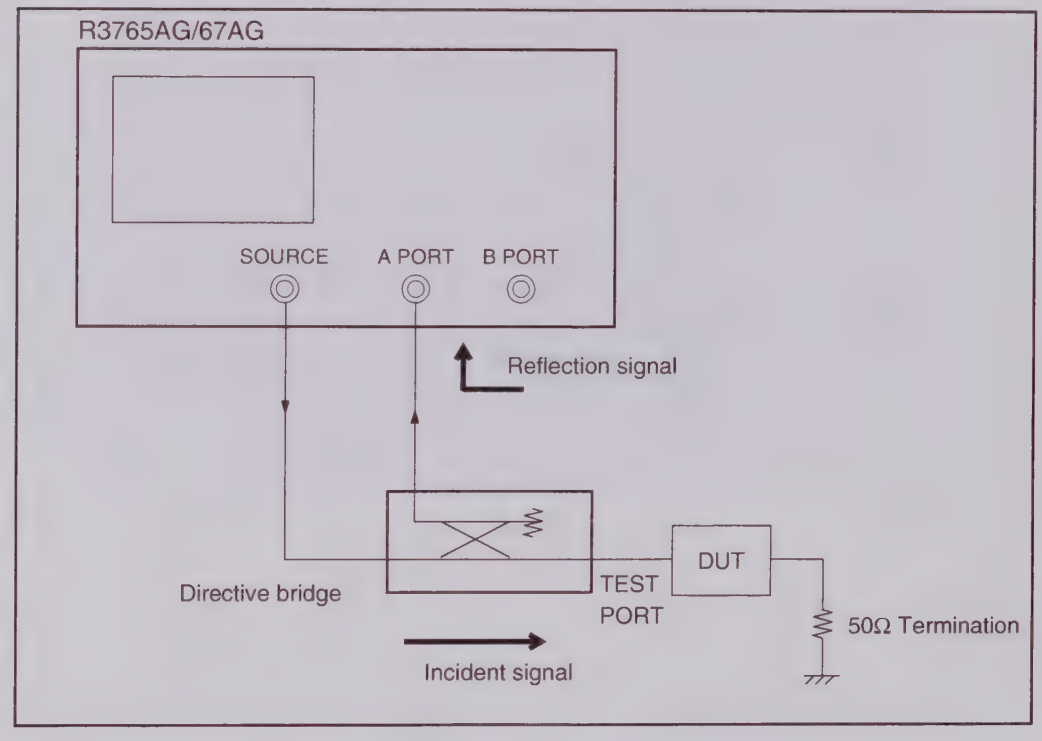


Figure 3-17 Setup for Reflection Characteristic Measurement (AG type)

In addition, transmission or reflection characteristics within a frequency range of 300 kHz to 3.6 GHz are easily measured using the R3961B S-parameter Test Set.

(2) BG/CG type

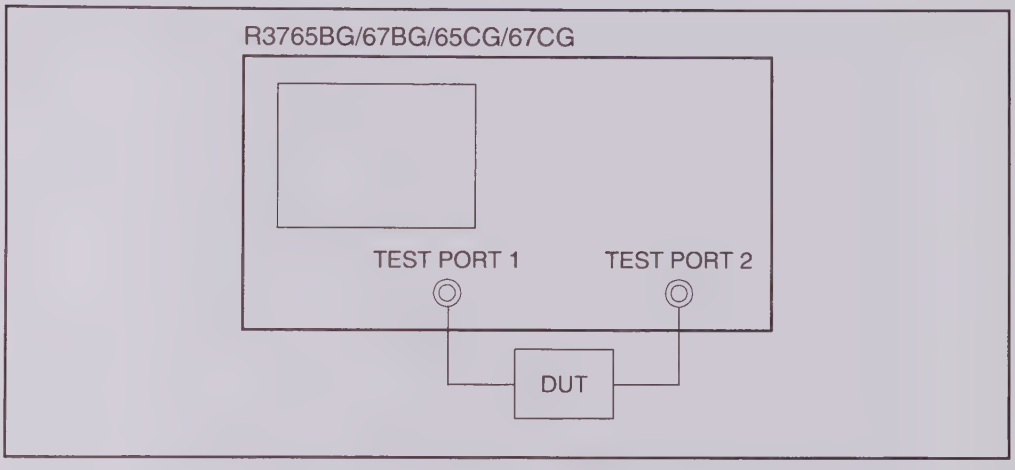


Figure 3-18 Setup for Reflection Characteristic Measurement (BG/CG Type)

- DUT of this measurement sample is a band pass filter of center frequency of 880MHz.
- All the displays used on the screen are display samples of R3767CG.

The displayed contents of input port in the upper left portion of the screen are different depending on the model.
The display of each type is as follows.

AG type	BG type	CG type
A/R	RFL	S11

RFL : REFLECTION

(3) Setting

① Press **[PRESET]** to preset.

② Setting of the R3765/67G series is as follows.

Block name	Setting	Key operation
ACTIVE CHANNEL	Set the channel to 1.	**[CH 1]** (Initial setup)
RESPONSE	Select the input port in the receiver part.	AG type : Bridge is used. **[MEAS]** → *{A/R}* (Initial setup) BG type : **[MEAS]** → *{REFLECTION}* (Initial setup) CG type : **[MEAS]** → *{S11 REFL FWD}* (Initial setup)
	Set the measurement format to magnitude (log display).	**[FORMAT]**→ *{LOG MAG}* (Initial setup)
STIMULUS	Center frequency 880MHz Span frequency 100MHz	**[CENTER]** → **[8]** → **[8]** → **[0]**→ **[MHz]** **[SPAN]** → **[1]** → **[0]** → **[0]** → **[MHz]**

Note: OPT11 or OPT14 uses a different [MEAS] menu.
For more information, refer to the description on page 7-10.

3.6.2 Calibration (1-port full calibration)

In the case of AG type, perform 1-port full calibration of bridge test port.

In the case of BG/CG type, perform 1-port full calibration of test port 1.

CAUTION!

1. ***If the calibration has already been executed, switch OFF the calibration, clear the calibration data, and then start calibration. (Refer to Section "7.5.10 Calibration Data Clear.")***
2. ***When the message "Wait for Sweep" disappeared, each calibration completes.***
   The above message may not be visible if measurement time is short. A beep sound is always heard when the calibration operation is complete.
3. ***During it's displayed the R3765/67G series, the cable, the connector, etc. must not be moved.***

① Select the calibration kit to be used. (refer to Section 7.5.7 Calibration Kit Selection).

② Invoke 1-port full calibration menu.

[CAL] → *{CAL MENU}* → *{1 PORT FULL CAL}*

③ Connect the open standard to the test port and acquire the calibration data.

{OPEN}

The display on the screen is as follows.

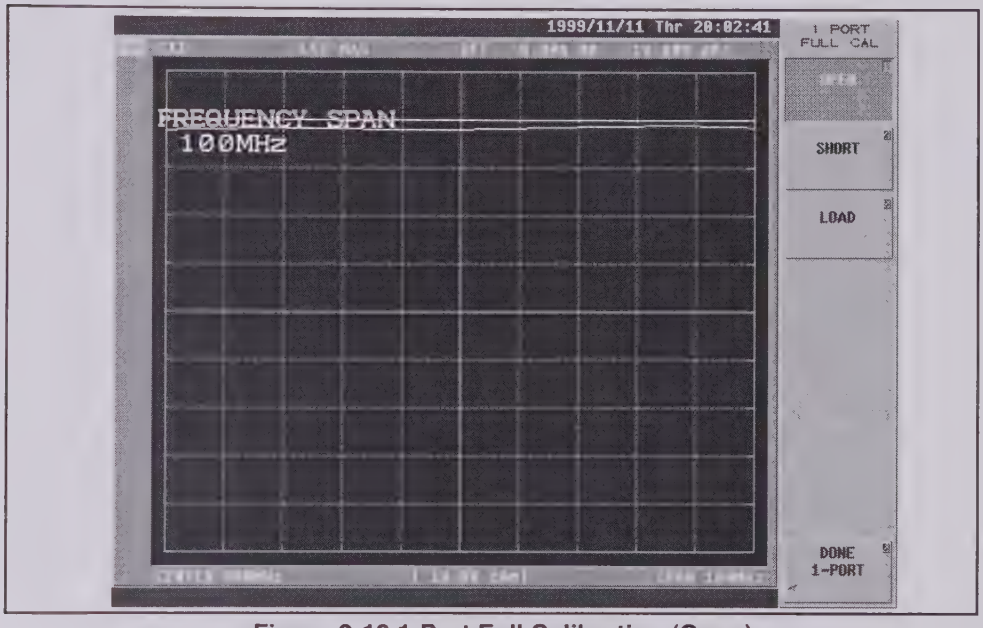


Figure 3-19 1-Port Full Calibration (Open)

④ Connect the short standard to the test port and acquire the calibration data.

{SHORT}

The display on the screen is as follows.

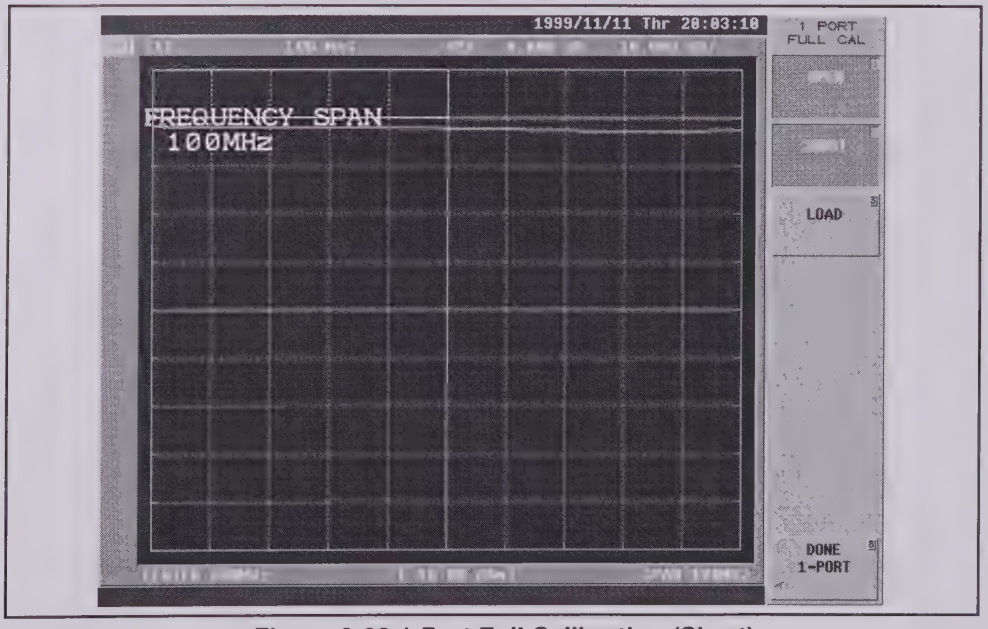


Figure 3-20 1-Port Full Calibration (Short)

⑤ Connect the load standard to the test port and acquire the calibration data.

{LOAD}

The display on the screen is as follows.

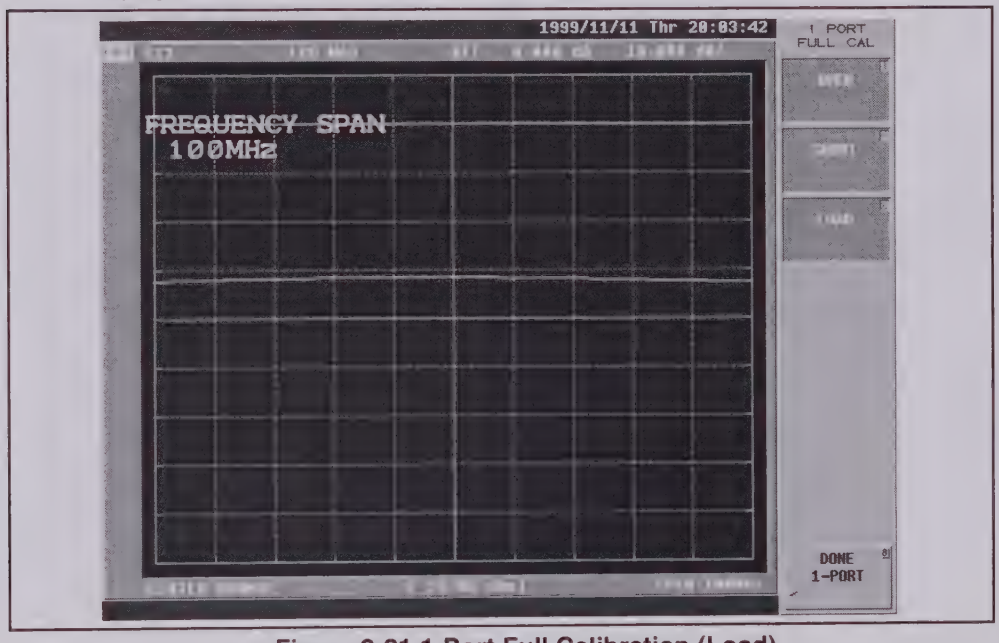


Figure 3-21 1-Port Full Calibration (Load)

⑥ Execute the calibration and end.

{DONE 1-PORT}

The calibration data becomes effective automatically.

⑦ Following the completion, return the connection to DUT (an example: filter).

3.6.3 Measurement by various formats

Here describes about measurement methods by various formats of reflection measurement (return loss, reflection coefficient, standing wave ratio, S parameter and impedance).

① Return loss (LOG MAG format setting) measurement

Adjust the scale to see the display trace (magnitude) easily.

[SCALE] → *{AUTO SCALE}*

Letting the reflective coefficient = ρ (= reflective signal/incident signal), the return loss is represented with the following equation.

Return loss = -20log (ρ)

The display on the screen (return loss) is as follows.

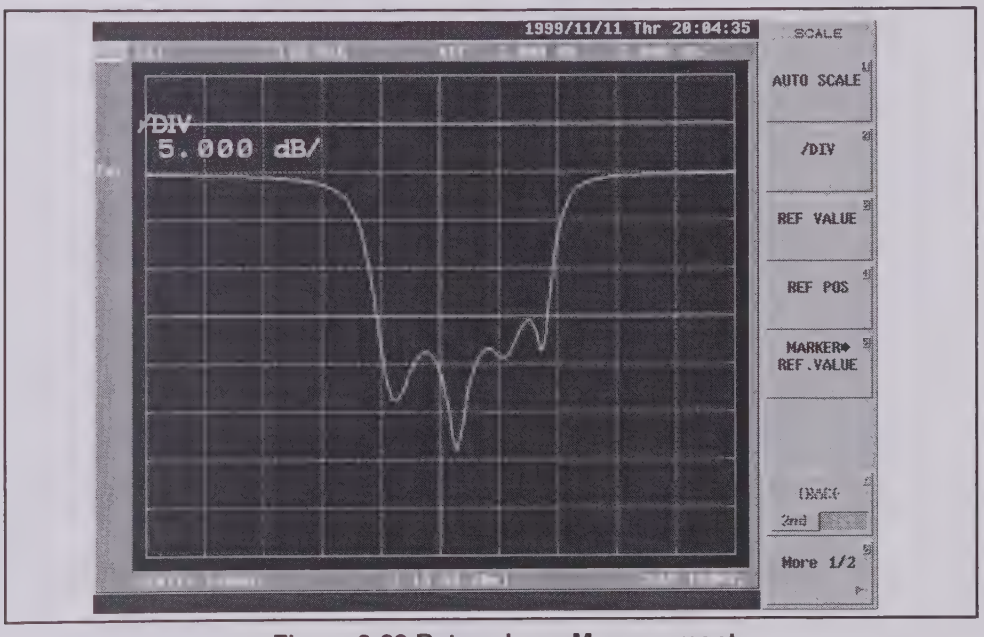


Figure 3-22 Return Loss Measurement

② Measurement of reflection coefficient (LIN MAG format setting)

The following operation is performed to display the return loss converted into reflection coefficient.

[FORMAT] → *{LIN MAG}*

Note: ***If the format soft menu has already been displayed, it's not necessary to press*** **[FORMAT].**

The top of the screen corresponds to reflection coefficient 1 (full reflection), and the bottom corresponds to reflection coefficient 0. The display becomes linear scale.

[SCALE] → *{AUTO SCALE}*

The display on the screen is as follows.

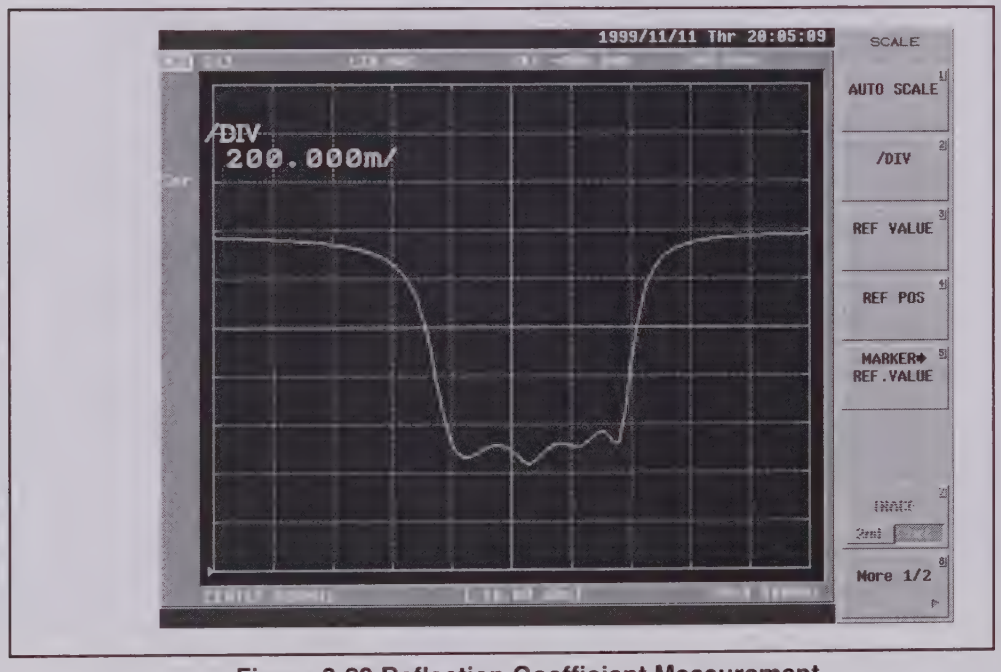


Figure 3-23 Reflection Coefficient Measurement

③ Standing wave ratio (SWR format setting) measurement

The following operation is performed to display the return loss as the standing wave ratio (SWR).

[FORMAT] → *{More 1/2}* → *{SWR}*

[SCALE] → *{AUTO SCALE}*

SWR=1 corresponds to the state of perfect matching.

The related expression between SWR and reflection coefficient ρ is as follows.

$$SWR = (1+\rho) / (1-\rho)$$

The display on the screen is as follows.

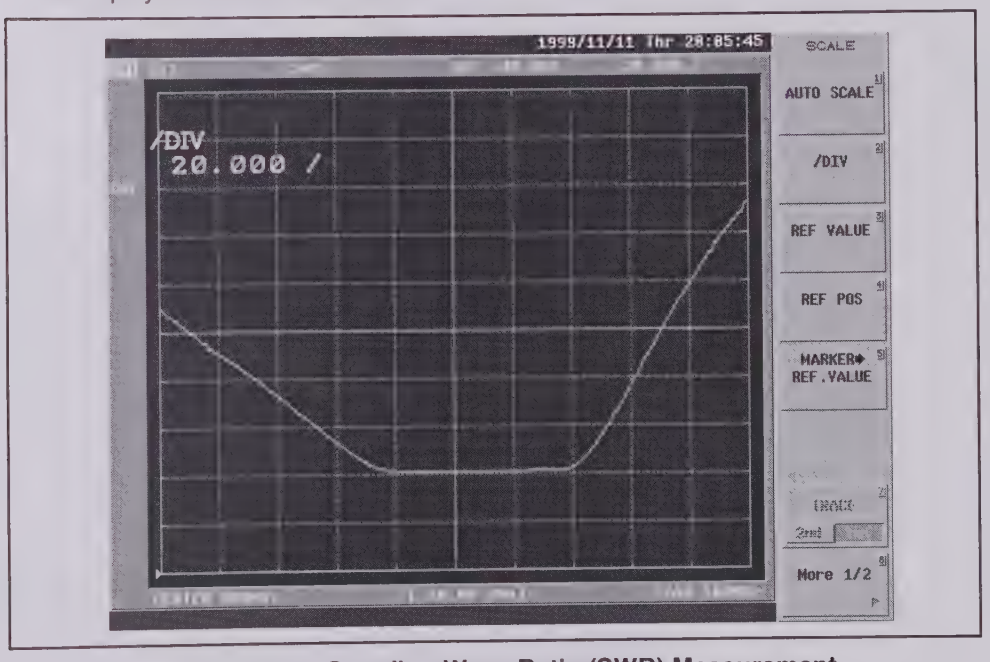


Figure 3-24 Standing Wave Ratio (SWR) Measurement

④ S parameter (POLAR format setting) measurement

The following operation is performed to display polar coordinates.

[FORMAT] → *{More 2/2}* → *{POLAR}*

The display on the screen is as follows.

Each coordinate shows the magnitude and the phase as follows.

(a) The magnitude is displayed with line and the size of the magnitude is displayed with the radius of the circle.
The center of the circle : Reflection coefficient 0 (The state of perfect matching)
The most outer circumference of the circle :
Reflection coefficient 1 (Full reflection)

(b) The phase is displayed with the angle from the plus direction of X axis.
It shows that the direction of 3 o'clock is phase angle 0° and the phases of the incident signal and the reflection signal are the same.

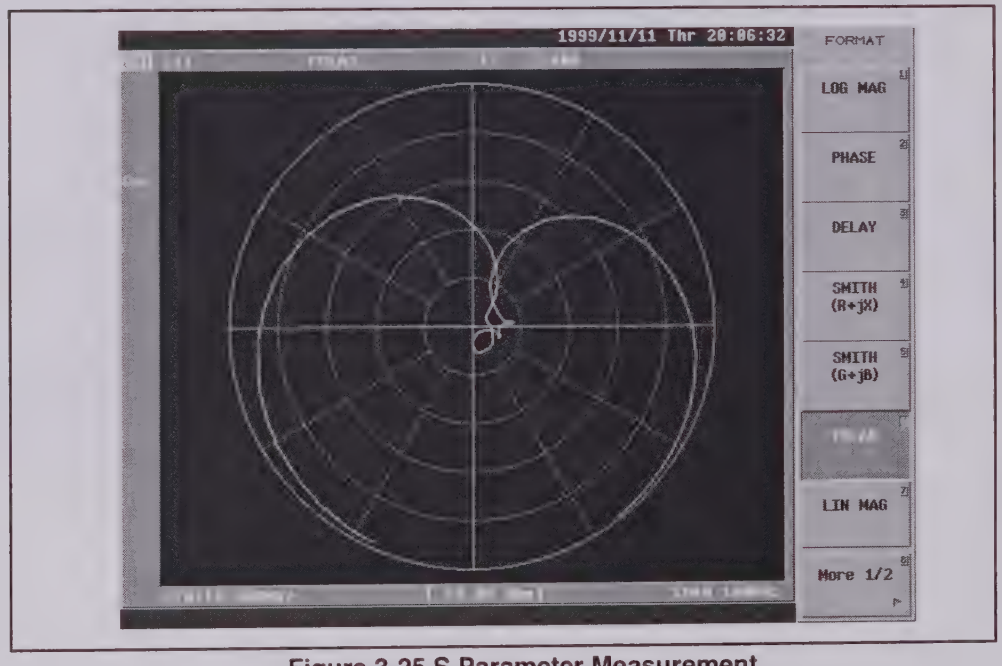


Figure 3-25 S Parameter Measurement

⑤ Impedance (Smith chart setting) measurement

The following operation is performed to make Smith chart.

[FORMAT] → *{SMITH (R+jX)}*

The display on the screen is as follows.

It shows that the impedance is inductive in the upper half circle of Smith chart and it is capacitive in the lower half circle.

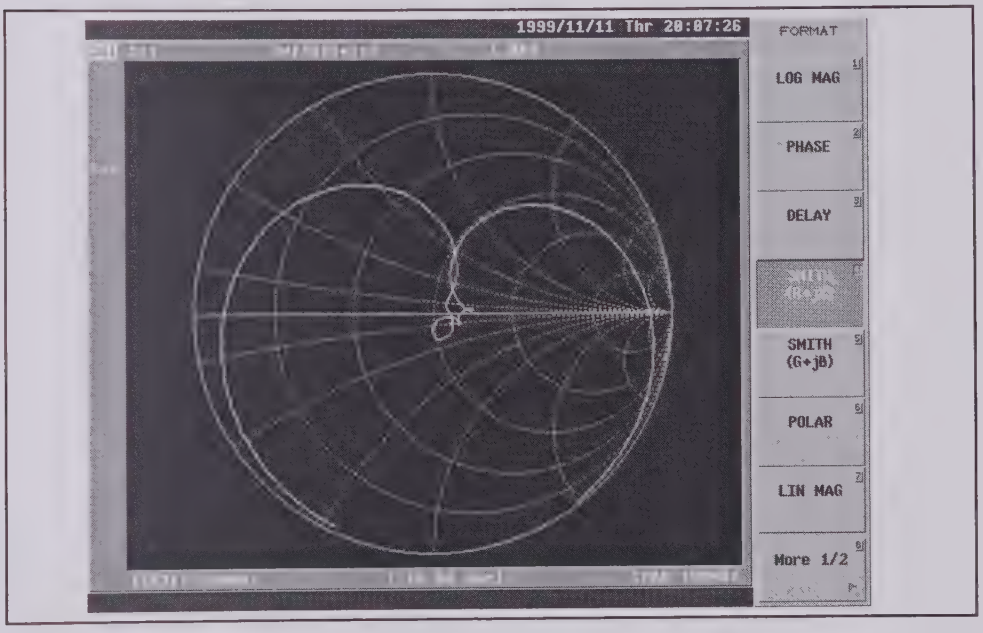


Figure 3-26 Impedance Measurement

⑥ The following operation is performed to convert to admittance chart.

Pressing **[FORMAT]** & *{SMITH (G+jB)}* displays the converted result.

4 BASICS OPERATION

This chapter describes about the keys and the soft menus of the R3765/67G series basically.

4.1 Basic Keys Operations

Front panel keys are grouped under the following six function blocks. The operation is performed by the combination of these blocks.

(1) ACTIVE CHANNEL block

The R3765/67G series has 2 measurement channels. (Refer to section 7.1.)
Select an active channel which can be set and changed.

(2) ENTRY block

Input numeric value to the selected function. (Refer to section 7.2.)

(3) STIMULUS block

Make the setting for the signal resource. (Refer to section 7.3.)

(4) RESPONSE block

Make setting of the receiver part and the information on the display screen. (Refer to section 7.4.)

(5) INSTRUMENT STATE block

Make the system setting such as save/recall or hard copy, etc. (Refer to section 7.11.)

(6) GPIB block

Make the setting of controller function and GPIB. (Refer to section 7.13.)

4.2 Basic Key Operation Examples

The key operation of the R3765/67G series is performed in the following three ways.

(1) The case that the numeric value data input is required.

[Panel key] → *{Soft key}* → **[Panel key]** in ENTRY block
[Panel key] → **[Panel key]** in ENTRY block

(2) The case that the selection is made only by soft key menu.

[Panel key] → *{Soft key}*
Pressing a key for more than about 0.5 seconds can input the key continuously.

4.3 Soft Key Menu Configuration

Soft key menu has two types, having more than two pages and hierarchy.

Refer to "A.4 Soft Key Menu List", for details.

(1) Soft key menu having more than two pages

Pressing *{More 1/2}* moves the page to the next, and pressing *{More 2/2}* returns the page to the previous.

(2) Soft key menu of hierarchy

Pressing *{Return}* returns to the previous hierarchy menu.

(3) Soft key menu of calibration data acquisition hierarchy

After executing *{DONE}*, returns to the previous hierarchy menu.

Some functions cannot be used because the models of the R3765/67G series are different. The menu related to these operations is not displayed.

4.4 Initial Setup

4.4.1 How to Initialize

Operating Procedure

- Press [**PRESET**] key.
  The contents of the setup is initialized to the following initial setup value.

4.4.2 Initial Setup Value

Table 4-1 Initial Setup Value (1 of 3)

Function	Initialize method	
	Power on or preset	*RST
Stimulus		
Sweep type	Linear frequency sweep	Linear frequency sweep
Continuous sweep	ON	OFF
Trigger source	Internal (FREE RUN)	Internal (FREE RUN)
Trigger delay	OFF (0sec)	OFF (0sec)
Sweep time	65.325msec (AUTO)	390.325msec (AUTO)
Measurement point	201	1201
Start frequency	300kHz	300kHz
Stop frequency	3.8GHz (R3765AG/BG/CG) 8.0GHz (R3767AG/BG/CG)	3.8GHz (R3765AG/BG/CG) 8.0GHz (R3767AG/BG/CG)
Frequency display	Start/Stop	Start/Stop
Fixed frequency of level sweep	1GHz	1GHz
Output level	* 1	* 1
Start level	* 2	* 2
Stop level	* 2	* 2
Two-channel interlocking	ON	ON
Program sweep segment	All clear	All clear
Response		
Dual channel	OFF	OFF
Active channel	CH1	CH1
Resolution bandwidth	10kHz	10kHz
Selection item of input port	* 3	* 3
Average	OFF (Number of times 16)	OFF (Number of times 16)
Trace operation	NONE	NONE
Conversion	NONE	NONE
Characteristic impedance Z_0	50Ω (75Ω for OPT12)	50Ω (75Ω for OPT12)
Measurement format	* 4	* 4
Group delay aperture	1%	0.01%
Smoothing	OFF (Aperture 1%)	OFF (Aperture 0.01%)
Display	Data	Data
Split/Overlap	Overlap	Overlap
Label	NONE	NONE

Function	Initialize method	
	Power on or preset	*RST
Reference value		
Logarithmic magnitude	0dB	0dB
Phase	0 °	0 °
Group delay	0sec	0sec
Smith chart	1	1
Polar coordinate	1	1
Linear magnitude	0	0
SWR	1	1
Real part	0	0
Imaginary part	0	0
Continuous phase	0 °	0 °
The value per division of Y-axis		
Logarithmic magnitude	* 5	* 5
Phase	45 °	45 °
Group delay	100nsec	100nsec
Smith chart	-	-
Polar coordinate	-	-
Linear magnitude	100m	100m
SWR	1	1
Rear part	1	1
Imaginary part	1	1
Continuous phase	360 °	360 °
Reference position		
Logarithmic magnitude	* 6	* 6
Phase	50%	50%
Group delay	50%	50%
Smith chart	-	-
Polar coordinate	-	-
Linear magnitude	0%	0%
SWR	0%	0%
Real part	50%	50%
Imaginary part	50%	50%
Continuous phase	50%	50%
Callibration		
Correct measurement	OFF	OFF
Calibration data	Clear	Clear
Electrical length correction	OFF (0sec)	OFF (0sec)
Phase offset	OFF (0 °)	OFF (0 °)
Measurement end extension correction	OFF	OFF
R input	0sec	0sec
A input	0sec	0sec
B input	0sec	0sec
Port 1	0sec	0sec
Port 2	0sec	0sec
Port 3 (with OPT11/13/14)	0sec	0sec
Port 4 (with OPT14)	0sec	0sec
Velocity factor	1	1

* 1 : Output level

Type	Power on or preset	*RST
AG	0dBm	0dBm
BG	0dBm	0dBm
CG, CG+OPT11	10dBm	10dBm
CG+OPT10, CG+OPT10+OPT11	5dBm	5dBm
CG+OPT12/13	4dBm	4dBm
CG+OPT10+OPT12/13	-1dBm	-1dBm
CG+OPT10+OPT14	3dBm	3dBm
CG+OPT14	8dBm	8dBm

* 2 : Start/Stop level

Type	Power on or preset		*RST	
	Start	Stop	Start	Stop
AG	-3dBm	0dBm	-3dBm	17dBm
AG+OPT10	-8dBm	0dBm	-8dBm	12dBm
BG	-13dBm	0dBm	-13dBm	7dBm
BG+OPT10	-18dBm	0dBm	-18dBm	2dBm
BG+12	-11dBm	0dBm	-11dBm	9dBm
BG+OPT10+OPT12	-16dBm	0dBm	-16dBm	4dBm
CG, CG+OPT11/14	-10dBm	0dBm	-10dBm	10dBm
CG+OPT12/13	-16dBm	0dBm	-16dBm	4dBm
CG+OPT10, CG+OPT10+OPT11/14	-15dBm	0dBm	-15dBm	5dBm
CG+OPT10+OPT12/13	-21dBm	-1dBm	-21dBm	-1dBm

* 3 : Selection item of input port

Type	CH1	CH2	CH3	CH4
AG	A/R	B/R	A/R	B/R
BG	REFLECTION	TRANSMISSION	REFLECTION	TRANSMISSION
CG	S_{11}	S_{21}	S_{11}	S_{21}

* 4 : Measurement format

Type	CH1	CH2	CH3	CH4
AG	LOG MAG	LOG MAG	LOG MAG	LOG MAG
BG	LOG MAG	LOG MAG	POLAR	LOG MAG
CG	LOG MAG	LOG MAG	POLAR	LOG MAG

* 5 : Logarithmic magnitude (the value per division of Y-axis)

Type	CH1	CH2	CH3	CH4
AG	10dB	10dB	1dB	1dB
BG	5dB	10dB	1 UNIT	1dB
CG	5dB	10dB	1 UNIT	1dB

* 6 : Logarithmic magnitude (reference position)

Type	CH1	CH2	CH3	CH4
AG	90%	90%	90%	90%
BG	90%	90%	-	90%
CG	90%	90%	-	90%

4.5 Setting Backup Memory (Factory Default Settings)

Table 4-2 Setting Backup Memory

Item	Initial value
GPIB address	11
System controller/Addressable	Addressable
Printer GPIB address	18
Plotter GPIB address	5
Save register	All clear

5 MEASUREMENT METHOD EXAMPLE

This chapter describes the operating method of the R3765/67G series.
All the screen displays used here are display sample of R3767CG.

5.1 Measurement of Transmission Characteristic (2 Trace Display)

5.1.1 Overlap Display Mode (Two Traces per Screen Measurement)

Here explains magnitude and phase measurement method using simultaneous display of 2 traces.

- 880MHz band-pass filter is used as DUT.

① Setup (refer to sub-section 3.5.1) and preset (refer to sub-section 4.4.1).

② The setting of the R3765/67G series is as follows.

Block name	Setting	Key operation
ACTIVE CHANNEL	Set the channel to 2.	**[CH 2]**
RESPONSE	Select the input port in the receiver part.	AG type : Bridge is used. **[MEAS]** → *{B/R}* (Initial setup) BG type : **[MEAS]** → *{TRANSMISSION}* (Initial setup) CG type : **[MEAS]** → *{S21 TRANS FWD}* (Initial setup)
	Set the measurement format to magnitude (log display) & phase.	**[FORMAT]** → *{More 1/2}* → *{LOG MAG & PHASE}*
STIMULUS	Center frequency 880MHz Span frequency 100MHz	**[CENTER]** → **[8]** → **[8]** → **[0]** → **[MHz]** **[SPAN]** → **[1]** → **[0]** → **[0]** → **[MHz]**

Note: OPT11 or OPT14 uses a different [MEAS] menu.
For more information, refer to the description on page 7-10.

③ Calibrate the frequency characteristic

Remove DUT and connect the through adapter instead.

Normalize in this state.

[CAL] → *{NORMALIZE (THRU)}*

Following the completion, return the connection to DUT (filter).

④ Change the scale of displayed trace

When the format is 2 trace simultaneous display like this, select which trace is to be changed by "TRACE".

Adjust the scale for the first trace (magnitude).

[SCALE] → *{AUTO SCALE}*

The display on the screen is as follows.
The display contents of input port on upper left of the screen are different depending on the model.

The display of each type is as follows. (Active channel : CH2)

AG type	BG type	CG type
B/R	TRN	S21

TRN : TRANSMISSION

The display section of input port (Example S21 : CG type)

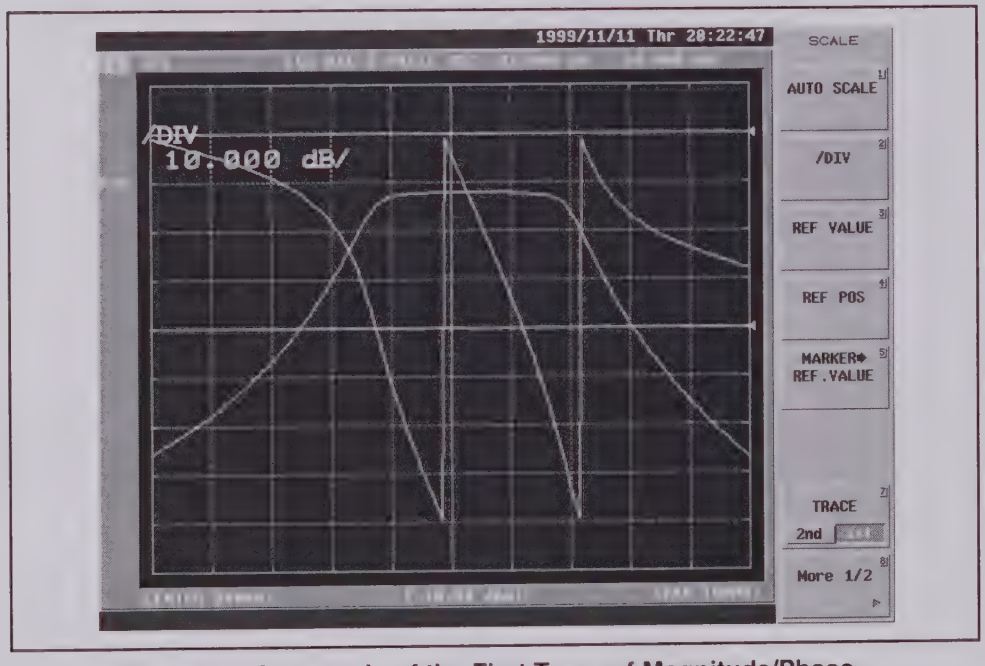


Figure 5-1 Auto-scale of the First Trace of Magnitude/Phase Measurement (Overlap Display)

⑤ In order to change the object of scale change to the second trace (phase), select 2nd by "TRACE".

The reference line is also switched to the second trace's.

Then the operation of marker also becomes effective to the second trace.

{TRACE 2nd/1st} → {AUTO SCALE}

The display on the screen is as follows.

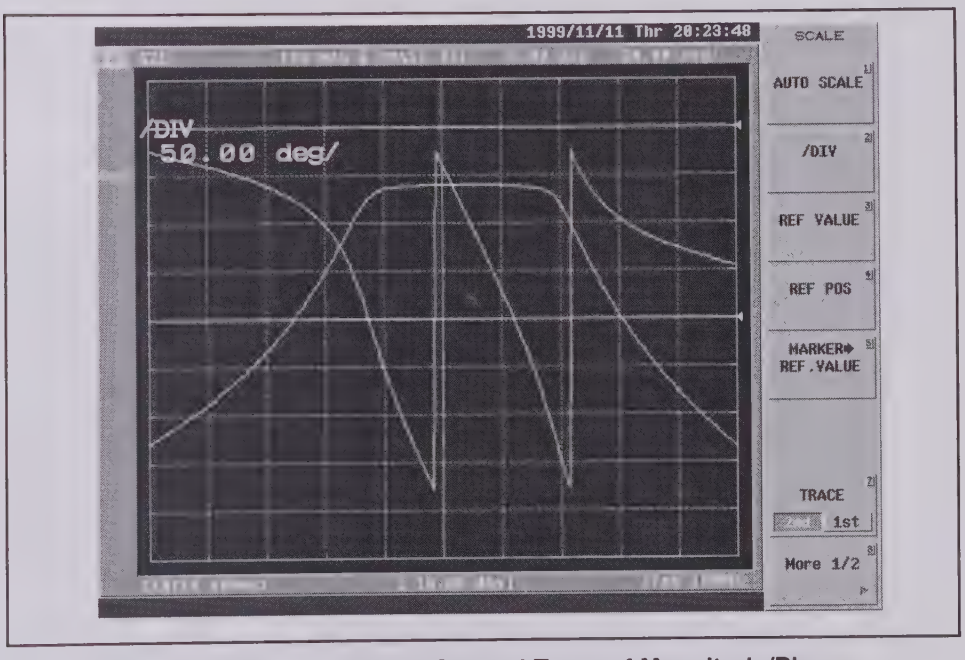


Figure 5-2 Auto-scale of the Second Trace of Magnitude/Phase Measurement (Overlap Display)

- By converting the format as follows, the measured results can be two-trace-overlap-displayed.

⑥ Logarithmic magnitude/group delay measurement

Set the format to logarithmic magnitude (the first trace)/group delay (the second trace) measurement.

[FORMAT] → *{More 1/2}* → *{LOG MAG & DELAY}*

The scale can be changed in the same way as ④ & ⑤.

[SCALE] → *{AUTO SCALE}*

{TRACE 2nd/1st} → *{AUTO SCALE}*

The display on the screen is as follows.

Figure 5-3 Logarithmic Magnitude/Group Delay Measurement (Overlap Display)

⑦ Linear magnitude/phase measurement

Set the format to linear magnitude (the first trace)/phase (the second trace) measurement.

[FORMAT] → *{LIN MAG & PHASE}*

The scale can be changed in the same way as ④ & ⑤.

[SCALE] → *{AUTO SCALE}*

{TRACE 2nd/1st} → *{AUTO SCALE}*

The display on the screen is as follows.

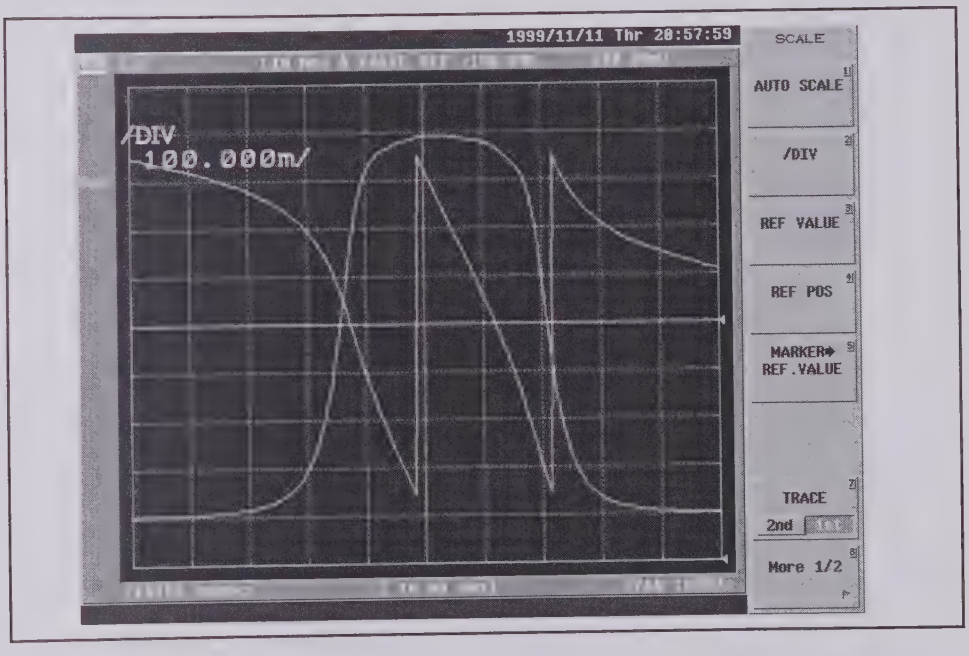


Figure 5-4 Linear Magnitude/Phase Measurement (Overlap Display)

5.1.2 Split Display

Here explains how to measure logarithmic magnitude and phase with simultaneous display of channel 1 and 2.

- 880MHz band-pass filter is used as DUT.

① Setup (refer to sub-section 3.5.1) and preset (refer to sub-section 4.4.1).

② The setting of the R3765/67G series is as follows.

Block name	Setting	Key operation
ACTIVE CHANNEL	Set the channel to 2.	**[CH 2]**
RESPONSE	Select the input port in the receiver part.	AG type : **[MEAS]** → *{B/R}* (Initial setup) BG type : **[MEAS]** → *{TRANSMISSION}* (Initial setup) CG type : **[MEAS]** → *{S21 TRANS FWD}* (Initial setup)
	Set the measurement format to magnitude (log display).	**[FORMAT]**→ *{LOG MAG}*
STIMULUS	Center frequency 880MHz Span frequency 100MHz	**[CENTER]** → **[8]** → **[8]** → **[0]** → **[MHz]** **[SPAN]** → **[1]** → **[0]** → **[0]** → **[MHz]**

③ Change the input port of channel 1.

Block name	Setting	Key operation
ACTIVE CHANNEL	Set the channel to 1.	**[CH 1]**
RESPONSE	Select the input port in the receiver part.	AG type : Bridge is used. **[MEAS]** → *{B/R}* BG type : **[MEAS]** → *{TRANSMISSION}* CG type : **[MEAS]** → *{S21 TRANS FWD}*

Note: OPT11 or OPT14 uses a different [MEAS] menu.
For more information, refer to the description on page 7-10.

④ Calibrate the frequency characteristic.

First, remove DUT and connect the through adapter instead.

Normalize in this state.

[CH 2] → **[CAL]** → *{NORMALIZE (THRU)}*

Following the completion, return the connection to DUT (filter).

⑤ Display two screens simultaneously.

[DISPLAY] → *{DUAL CH ON/OFF}* → *{SPLIT CH ON/OFF}*

⑥ In two screens display, the operation of format or scale, etc. is performed to the active channel independently. The display of active channel becomes inverted one and the frame of the screen display changes to white.

Set channel 2 to the phase display.

[FORMAT] → *{PHASE}*

This corresponds to the logarithmic magnitude/phase measurement (overlap display) of sub-section 5.1.1.

Figure 5-5 Logarithmic Magnitude/Phase Measurement (Split Display)

⑦ Set channel 2 to the group delay display.

{DELAY} → **[SCALE]** → *{AUTO SCALE}*
The display on the screen is as follows.

This corresponds to the logarithmic magnitude/group delay measurement (overlap display) of sub-section 5.1.1.

Figure 5-6 Logarithmic Magnitude/Group Delay Measurement (Split Display)

⑧ Set channel 2 to the phase and channel 1 to the linear magnitude.

[FORMAT] → *{PHASE}*

[CH 1] → *{LIN MAG}* → **[SCALE]** → *{AUTO SCALE}*

The display on the screen is as follows.

This corresponds to the linear magnitude/phase measurement (overlap display) of sub-section 5.1.1.

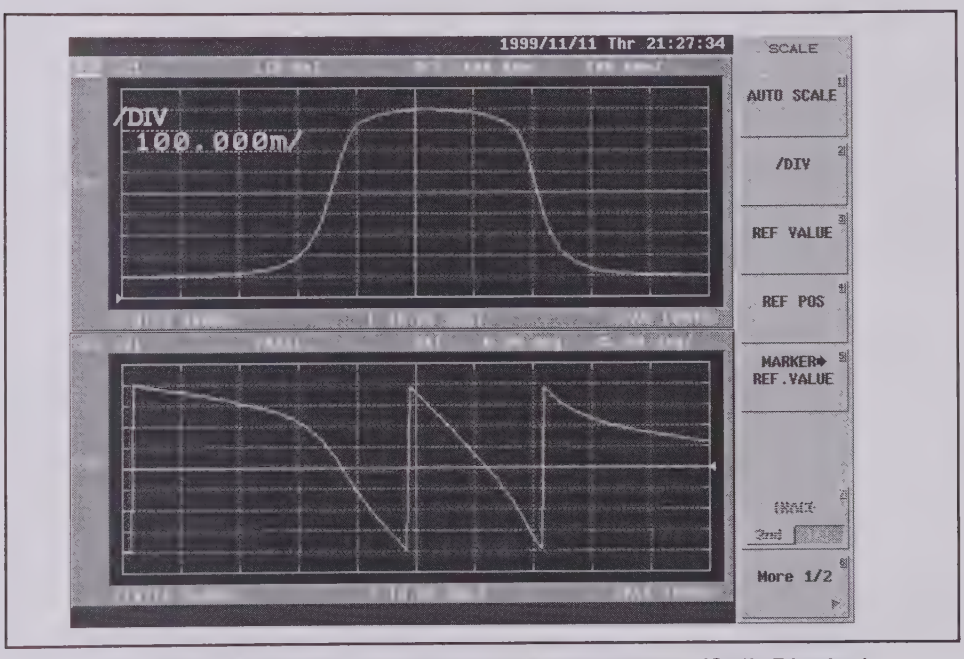


Figure 5-7 Linear Magnitude/Phase Measurement (Split Display)

5.2 Transmission/Reflection Characteristic Measurement (Four Screen Display Mode)

5.2.1 Setup

Here explains how to measure all S parameters with four screen display.

S parameter measurement is possible only when CG type is used.

Four screen display is possible for either AG type or BG type.

- 880MHz band-pass filter is used as DUT.

① Setup.

CG type

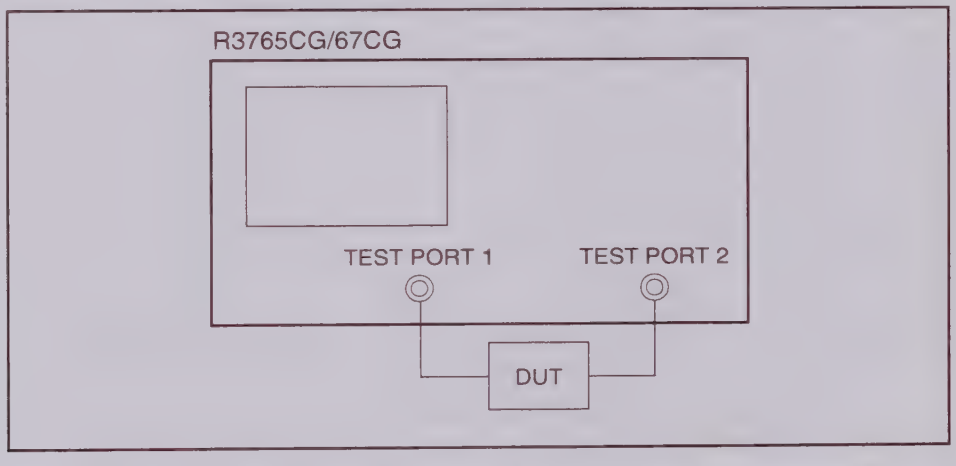


Figure 5-8 Setup of the Reflection Characteristic Measurement

② Setup the R3765/67G series as follows.

First, preset by pressing **[PRESET]**.

Block name	Setting	Key operation
ACTIVE CHANNEL	Set the channel to 1.	**[CH 1]** (Initial setup)
RESPONSE	Select the input port in the receiver part.	CG type **[MEAS]** → *{S11 REFL FWD}* (Initial setup)
	Set the measurement format to magnitude (log display).	**[FORMAT]** → *{LOG MAG}* (Initial setup)
STIMULUS	Center frequency 880MHz Span frequency 100MHz	**[CENTER]** → **[8]** → **[8]** → **[0]** → **[MHz]** **[SPAN]** → **[1]** → **[0]** → **[0]** → **[MHz]**

Note: OPT11 or OPT14 uses a different [MEAS] menu.
For more information, refer to the description on page 7-10.

5.2.2 Calibration (two port full calibration)

Here explains about the calibration of the directivity of 2-port-device forward direction and inverse direction, the source match, the load match, the frequency tracking and the isolation.

By this calibration, all S parameters of 2-port-device can be measured at the highest accuracy.

The S parameter measurement is available only using the CG type network analyzer.

CAUTION!

1. ***If the calibration has already been executed, switch OFF the calibration, clear the calibration data, and then start the calibration. (Refer to Section "7.5.10 Calibration Data Clear.")***
2. ***When the message "Wait for Sweep" disappeared, each calibration completes. The above message may not be visible if measurement time is short. A beep sound is always heard when the calibration operation is complete.***
3. ***During it's displayed, the R3765/67G series, the cable, the connector, etc. must not be moved.***

① Select the calibration kit to be used. (refer to Section 7.5.7 Calibration Kit Selection).

② Invoke 2-port full calibration menu.

[CAL] → *{CAL MENU}* → *{2PORT CAL MENU}* → *{2PORT FULL CAL}*

③ Invoke the reflection menu of 2-port reflection calibration.

{REFLECT'N}

④ Connect the open-standard to the test port 1 and acquire calibration data.

Pressing *{S11(PORT 1) FWD:OPEN}*
The display on the screen becomes is as follows.

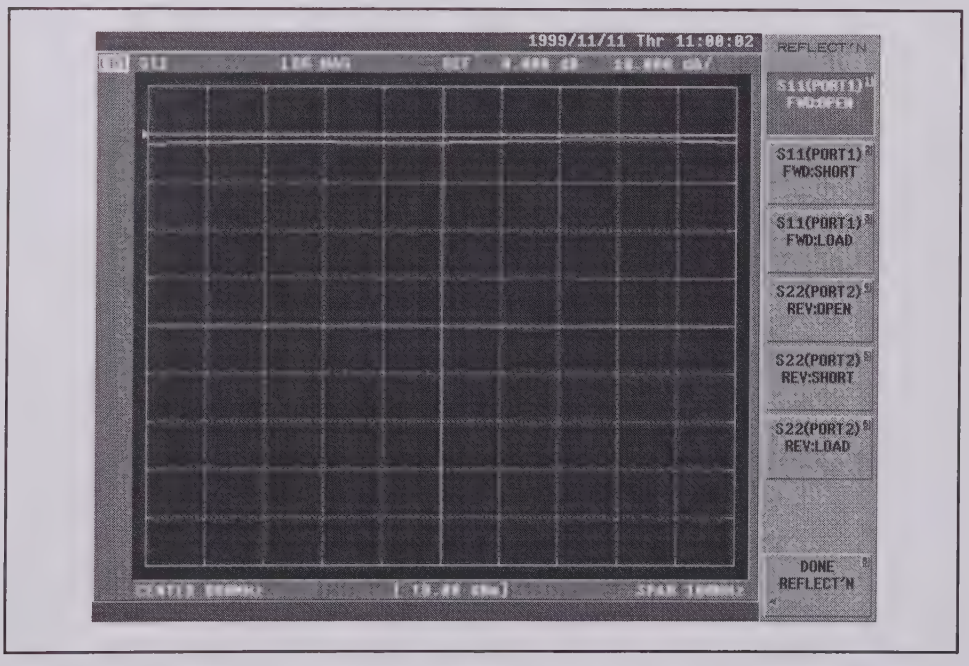


Figure 5-9 Calibration of 2-Port Reflection (Test Port/Open)

⑤ Connect the short-standard to the test port 1 and acquire calibration data.
{S11(PORT 1) FWD:SHORT}
The display on the screen is as follows.

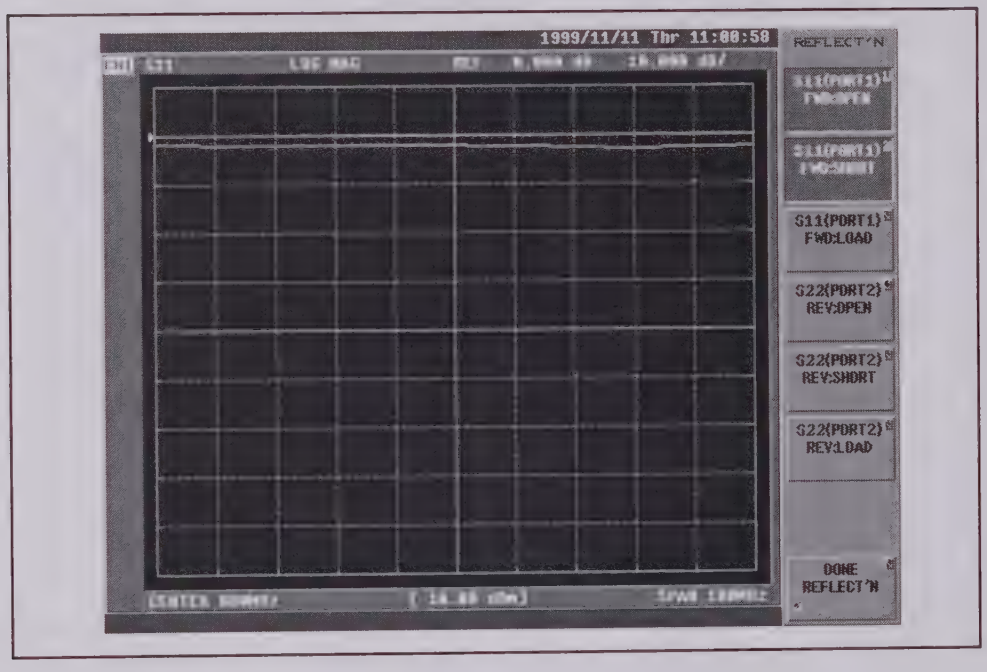


Figure 5-10 Calibration of 2-Port Reflection (Test Port/Short)

⑥ Connect the load-standard to the test port 1 and acquire calibration data.

{S11(PORT 1) FWD:LOAD}

The display on the screen is as follows.

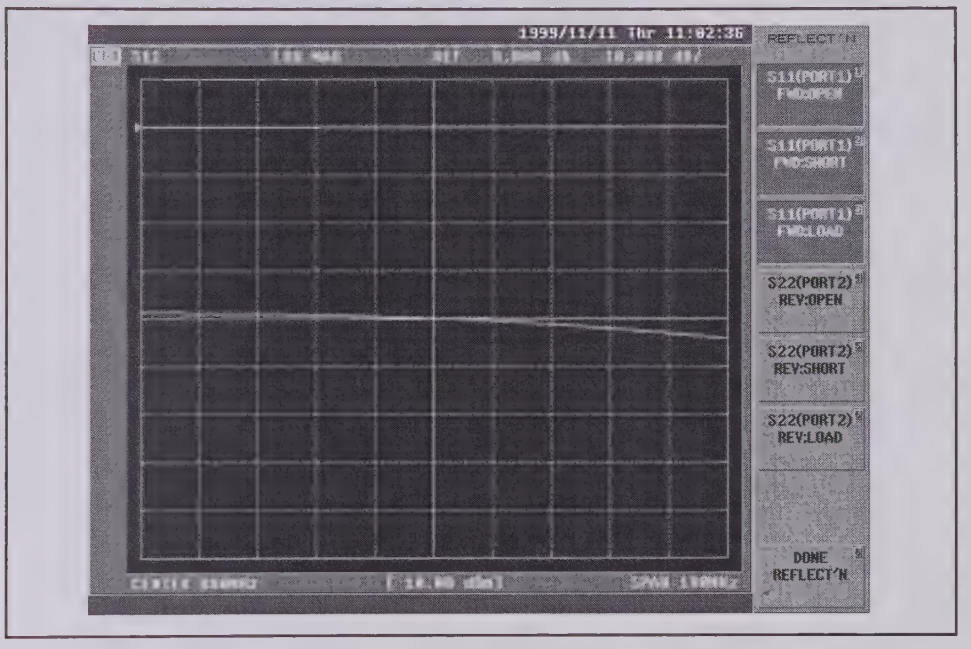


Figure 5-11 Calibration of 2-Port Reflection (Test Port/Load)

⑦ Calibrate the test port 2 in the same way as the test port 1.

Connect the open-standard to the test port 2 and acquire calibration data.

{S22(PORT 2) REV:OPEN}

⑧ Connect the short-standard to the test port 2 and acquire calibration data.

{S22(PORT 2) REV:SHORT}

⑨ Connect the load-standard to the test port 2 and acquire calibration data.

{S22(PORT 2) REV:LOAD}

⑩ Execute calibration of the reflection characteristic.

{DONE REFLECT'N}

Calibration data of each calibration standard can be acquired again before this key is pressed.

Following the completion of the reflection characteristic calibration, returns to 2-port full calibration menu.

The display on the screen is as follows.

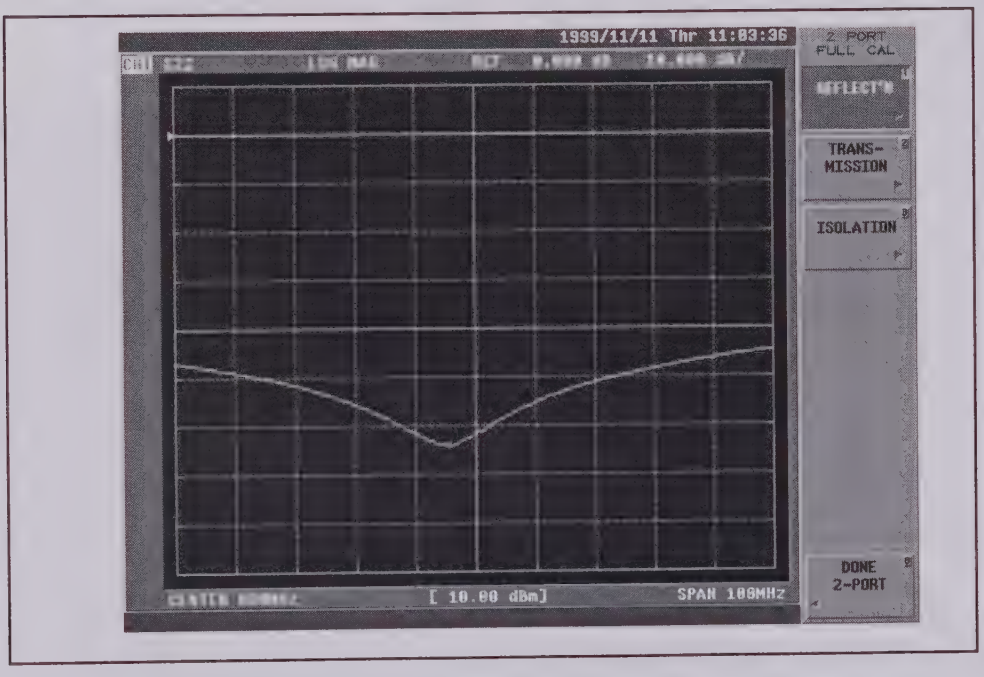


Figure 5-12 Execution of 2-Port Reflection Characteristic Calibration

⑪ Invoke transmission menu of 2-port transmission characteristic calibration.
{TRANSMISSION}

⑫ Connect the through-standard between test port 1 and test port 2.

{FWD.TRANS THRU}

The display on the screen is as follows.

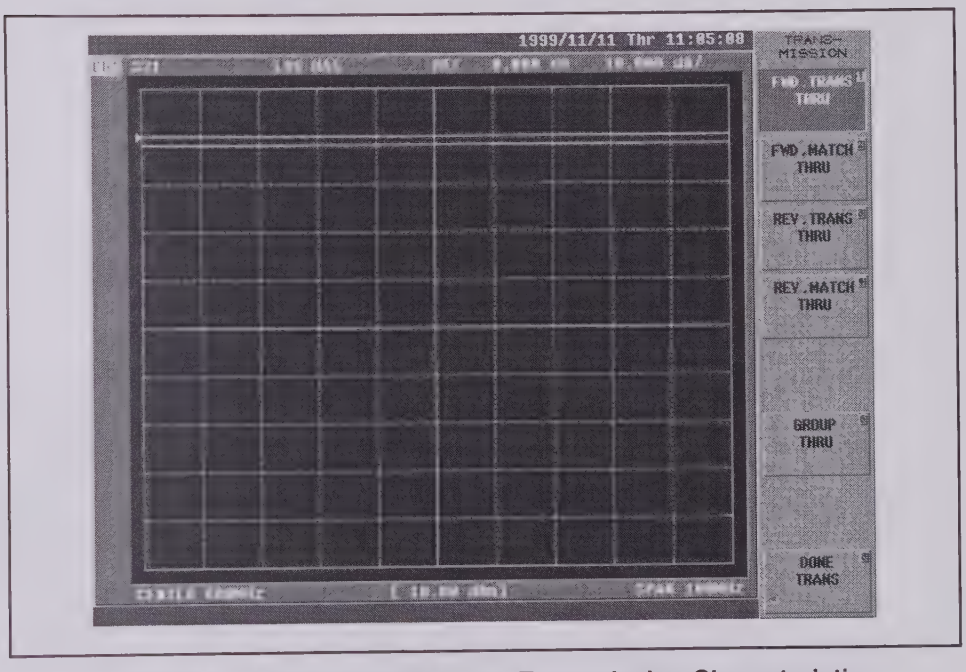


Figure 5-13 Calibration of 2-Port Transmission Characteristic (Forward Direction)

⑬ Acquire the following each calibration data.

{FWD.MATCH THRU} *

{REV.TRANS THRU} *

{REV.MATCH THRU} *

* : *{GROUP THRU}* can be substituted.

⑭ Execute calibration of the transmission calibration.

{DONE TRANS}

Calibration data of each calibration standard can be acquired again before this key is pressed.

Following the completion of transmission characteristic calibration, returns to 2-port full calibration menu.

The display on the screen is as follows.

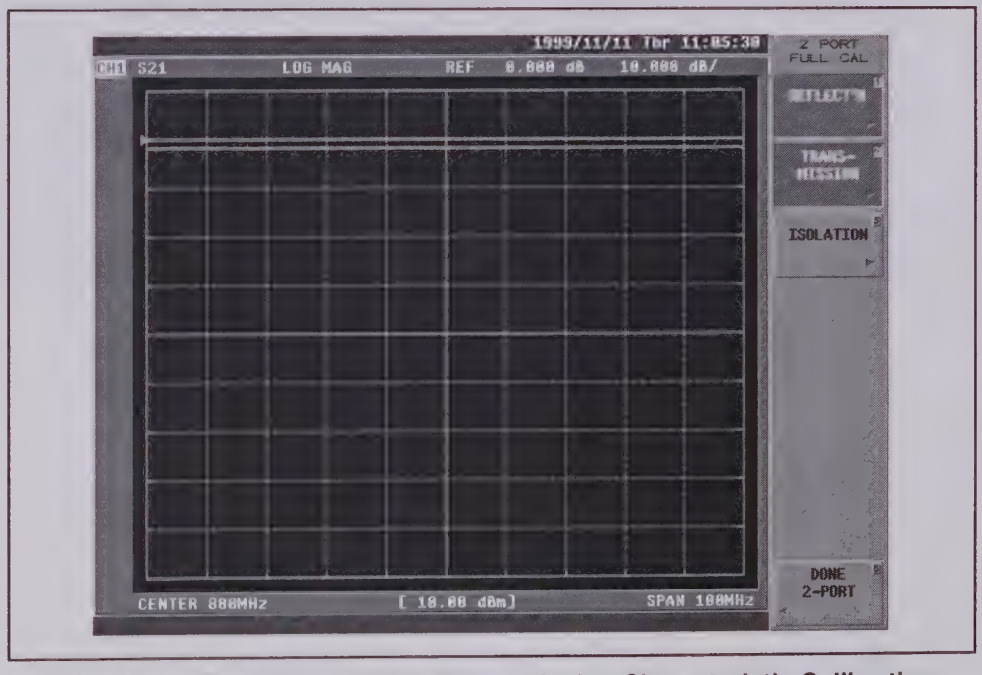


Figure 5-14 Execution of 2-Port Transmission Characteristic Calibration

⑮ Invoke 2-port isolation menu.

{ISOLATION}

⑯ When the isolation calibration is omitted,

{OMIT ISOLATION}

When the isolation calibration is performed,

Connect the load-standard to the test port 1 and the test port 2 to acquire calibration data.

{FMD ISOL'N}

{REV ISOL'N}

⑰ Executes the isolation calibration

{DONE ISOLATION}

Following the completion of the isolation calibration, returns to 2-port full calibration menu.

The display on the screen is as follows.

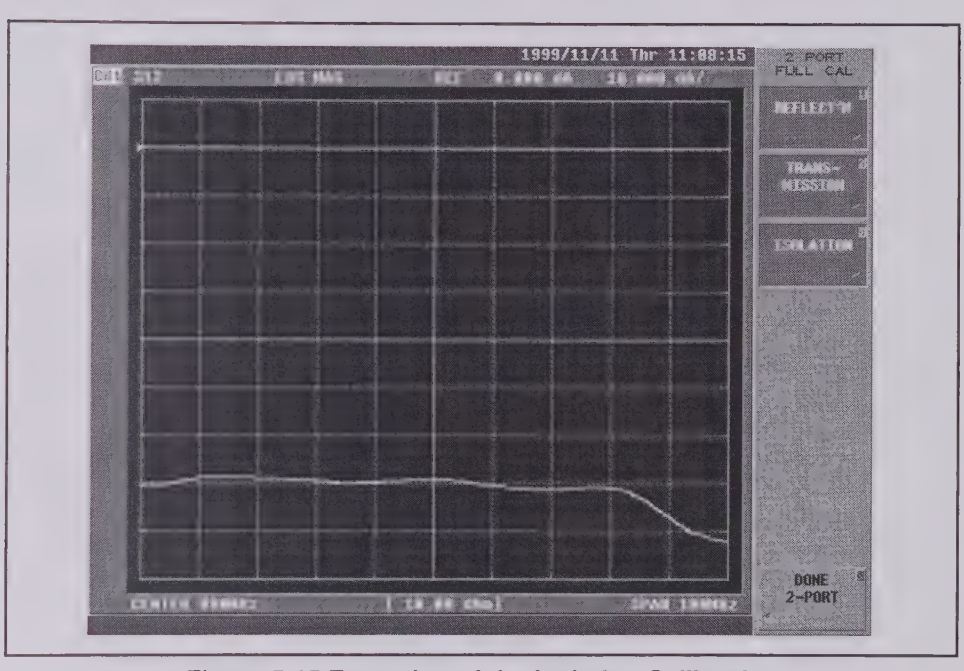


Figure 5-15 Execution of the Isolation Calibration

⑱ Executes 2-port full calibration

{DONE 2-PORT}

The display on the screen is as follows.

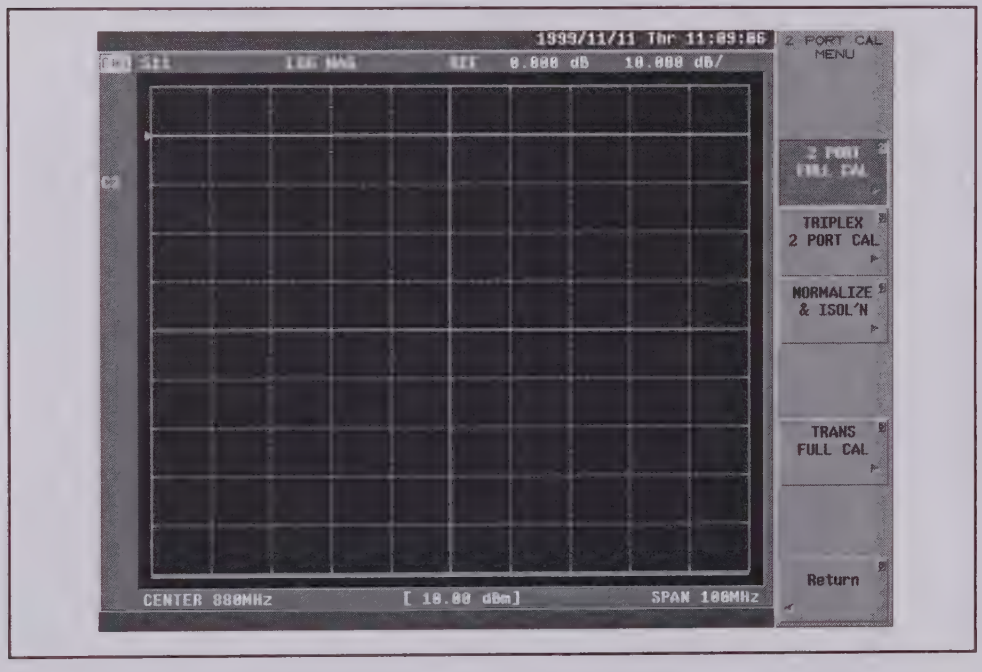


Figure 5-16 Execution of 2-Port Full Calibration

Connect DUT again and perform the measurement.

5.2.3 Four Screen Display

Here explains how to operate 4 screen display of all S parameters.

The following is a sample of 4 screen display.

[CH1] : S11 Smith chart [SMITH (R+jX)]	[CH2] : S12 Magnitude/Phase [LOG MAG & PHASE]
[CH3] : S22 Smith chart [SMITH (R+jX)]	[CH4] : S21 Magnitude/Group delay time [LOG MAG & DELAY]

The position of channel 1 to 4 is fixed, but the measurement mode, the format and the scale, etc. can be set to active channel independently.

① Set S11 Smith chart to channel 1.

[FORMAT] → *{SMITH (R+jX)}*

The display on the screen is as follows.

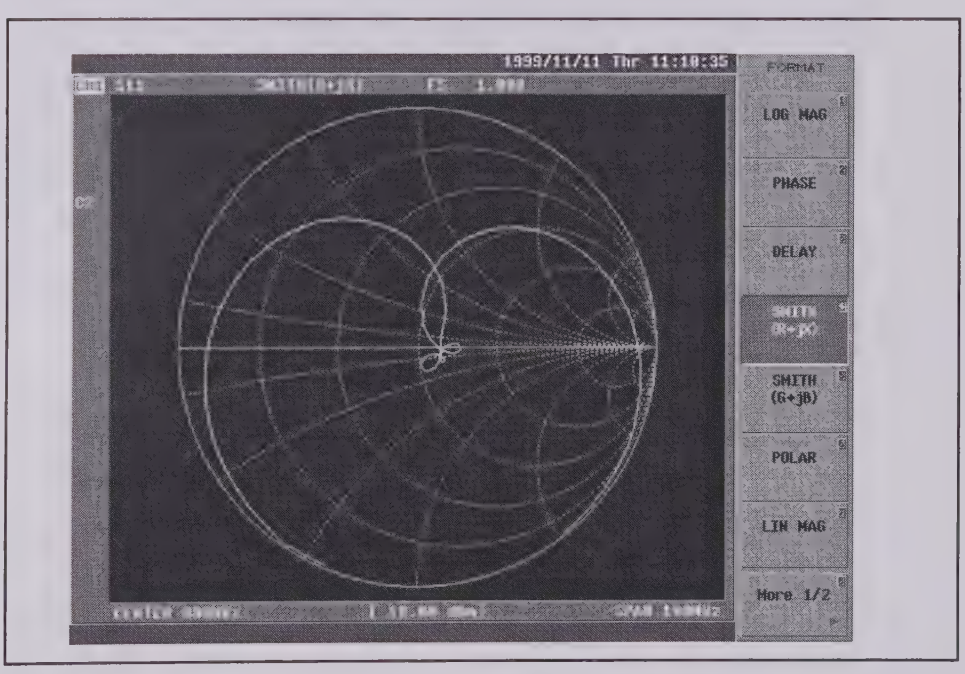


Figure 5-17 4 Screen Display (Channel 1)

② Select S22 for channel 3.

[MEAS] → *{SUB MEAS ON/OFF}* → *{S22 REFL REV}*

└ Switch ON.

The active channel is switched to 3 and the format is set with Smith chart.

[FORMAT] → *{SMITH (R+jX)}*

Each time **[CH 1]** is pressed, the active channel is switched between channel 1 and channel 3.

The display on the screen is as follows.

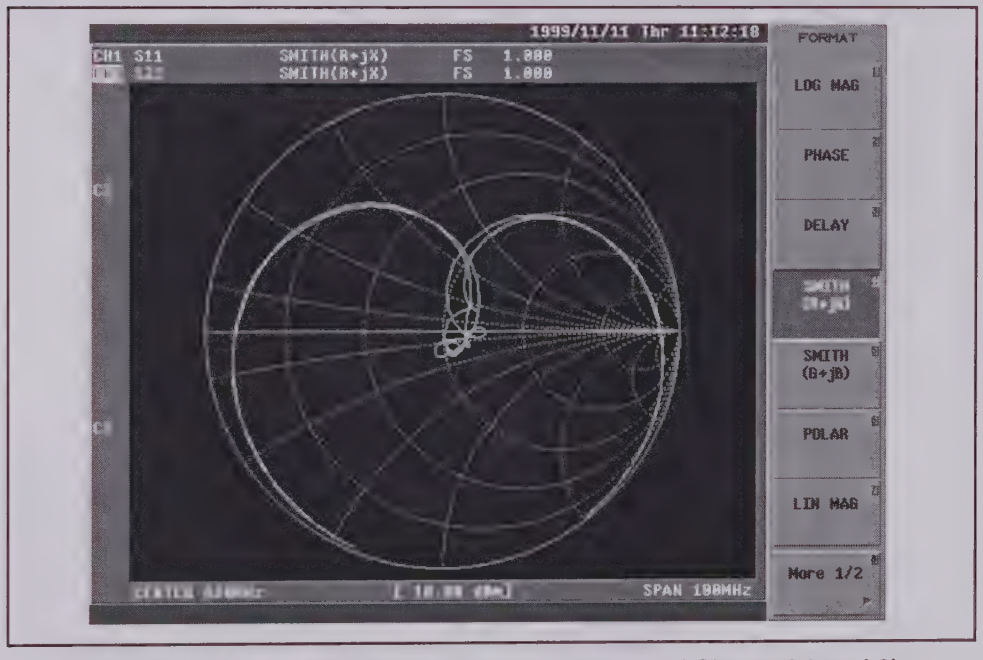


Figure 5-18 4 Screen Display (Overlap Display of Channel 1 and 3)

Note: OPT11 or OPT14 uses a different [MEAS] menu.
For more information, refer to the description on page 7-10.

③ Split-displays channel 1 and 3.

[DISPLAY] → *{SPLIT CH ON/OFF}*

Each time **[CH 1]** is pressed, the active channel is switched between channel 1 and 3.

The display on the screen is as follows.

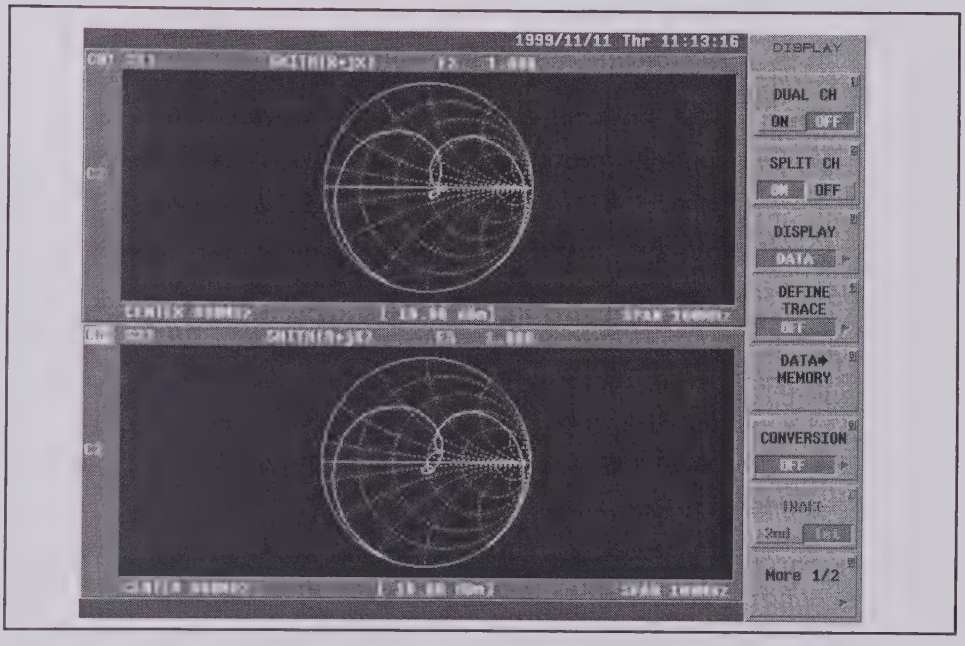


Figure 5-19 4 Screen Display (Split Display of Channel 1 and 3)

④ Select S12 for channel 2.

[CH 2] → **[MEAS]** → *{S12 TRANS REV}*

Change the format to logarithmic magnitude and phase.

[FORMAT]→ *{More 1/2}* → *{LOGMAG & PHASE}*

Adjust the scale.

[SCALE] → *{AUTO SCALE}* → *{TRACE 2nd/1st}* → *{AUTO SCALE}*

The display on the screen is as follows.

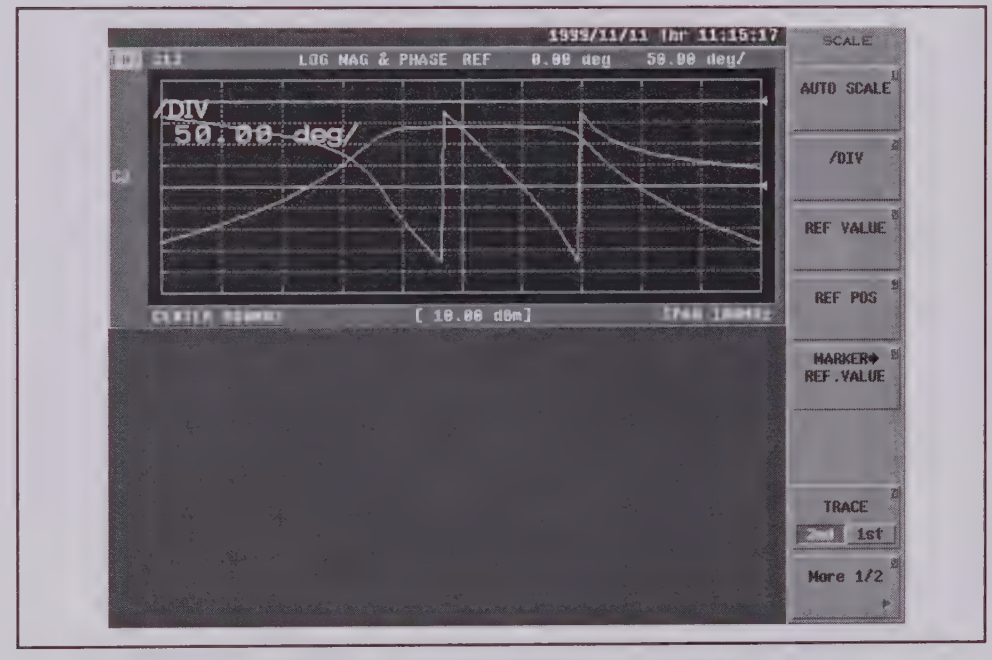


Figure 5-20 4 Screen Display (Channel 2)

Note: OPT11 or OPT14 uses a different [MEAS] menu.
For more information, refer to the description on page 7-10.

⑤ Select S21 for channel 4.

[MEAS] → *{SUB MEAS ON/OFF}* → *{S21 TRANS FWD}*
└ Switch ON.

Active channel is switched to 4 and the format is set with logarithmic magnitude & group delay.

[FORMAT] → *{LOG MAG & DELAY}*

Each time **[CH 2]** is pressed, the active channel is switched between channel 2 and channel 4.

Adjust the scale.

[SCALE] → *{AUTO SCALE}* → *{TRACE 2nd/1st}* → *{AUTO SCALE}*

The display on the screen is as follows.

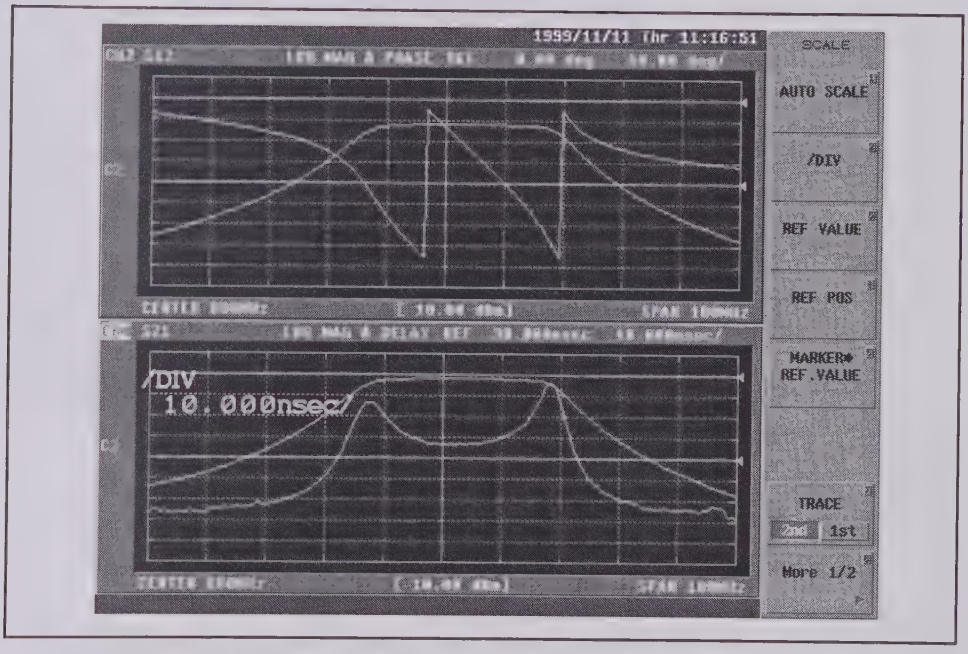


Figure 5-21 4 Screen Display (Split Display of Channel 2 and 4)

Note: OPT11 or OPT14 uses a different [MEAS] menu.
For more information, refer to the description on page 7-10.

⑥ Dual-display channel 1 (channel 3) and channel 2 (channel 4).

[DISPLAY] → *{DUAL CH ON/OFF}*

Then the active channel becomes channel 4.

Each time **[CH 2]** is pressed, the channel is switched to 2.

When channel 1 or channel 3 is required to change to active channel, press **[CH 1]**.

The display on the screen is as follows.

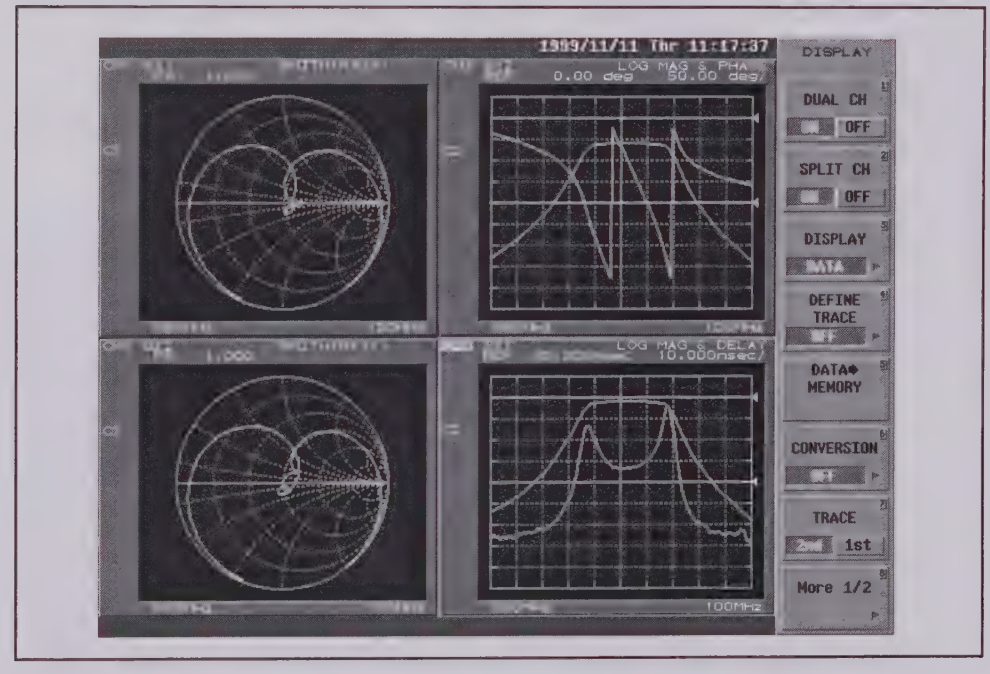


Figure 5-22 The Finished 4 Screen Display

5.3 Narrow Band/Wide Band Sweep Measurement

Here explains how to set different measurement conditions between channel 1 and 2.

- 880MHz band-pass filter is used as DUT.

① Setup (filter connection) (refer to sub-section 3.5.1) and preset (refer to sub-section 4.4.1).

② Set the measurement conditions of channel 1 and channel 2 independently.

[MEAS] → *{COUPLED CH ON/OFF}*

③ Set the measurement mode, the bandwidth and the format of channel 1.

[MEAS]

AG type : *{B/R}*

BG type : *{TRANSMISSION}*

CG type : *{S21 TRANS FWD}*

[CENTER]→ **[8]** → **[8]** → **[0]** → **[MHz]**

[SPAN] → **[1]** → **[0]** → **[0]** → **[MHz]**

[FORMAT]→ *{LOG MAG}*

④ Set the format and the bandwidth of channel 2.

[CH 2]

[CENTER]→ **[8]** → **[8]** → **[0]** → **[MHz]**

[SPAN] → **[6]** → **[0]** → **[0]** → **[MHz]**

[FORMAT] → *{LOG MAG}*

⑤ Calibrate the frequency characteristic of channel 1.

Remove DUT and connect the through adapter instead.

Normalize in this state.

[CH 1] → **[CAL]** → *{NORMALIZE (THRU)}*

Note: OPT11 or OPT14 uses a different [MEAS] menu.
For more information, refer to the description on page 7-10.

⑥ Calibrate the frequency characteristic of channel 2 in the same way.

[CH 2] → *{NORMALIZE (THRU)}*

Following the completion, return the connection to DUT (filter).

⑦ Display two channels simultaneously.

[DISPLAY] → *{DUAL CH ON/OFF}*

The measurement screen is as follows.

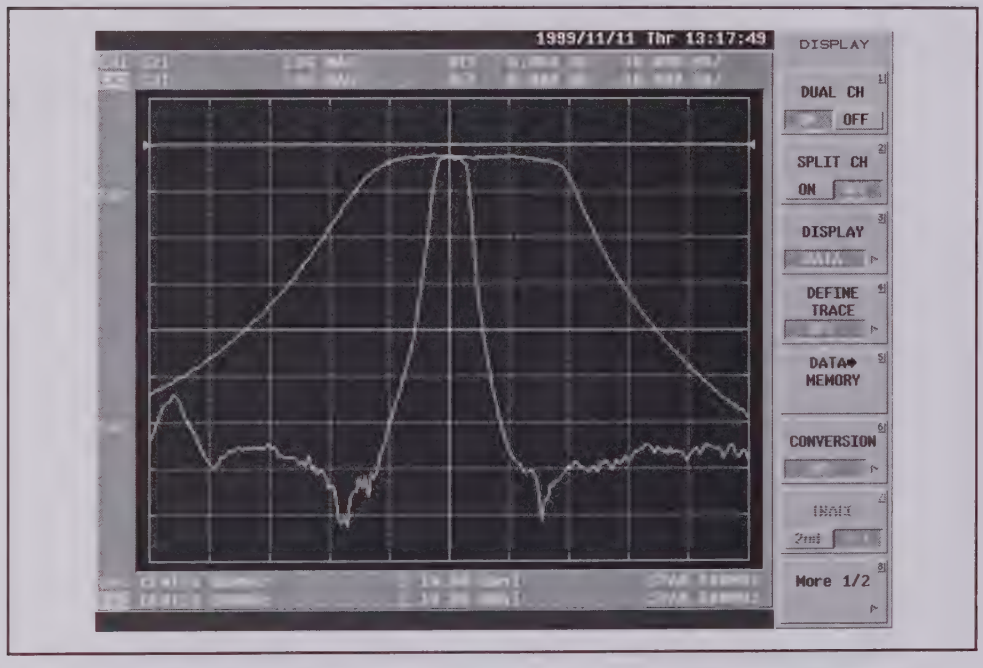


Figure 5-23 Two Channels Simultaneous Display (Overlap Display)

⑧ Display split into two parts, upper and lower. (Split display)

{SPLIT CH ON/OFF}

The measurement screen is as follows.

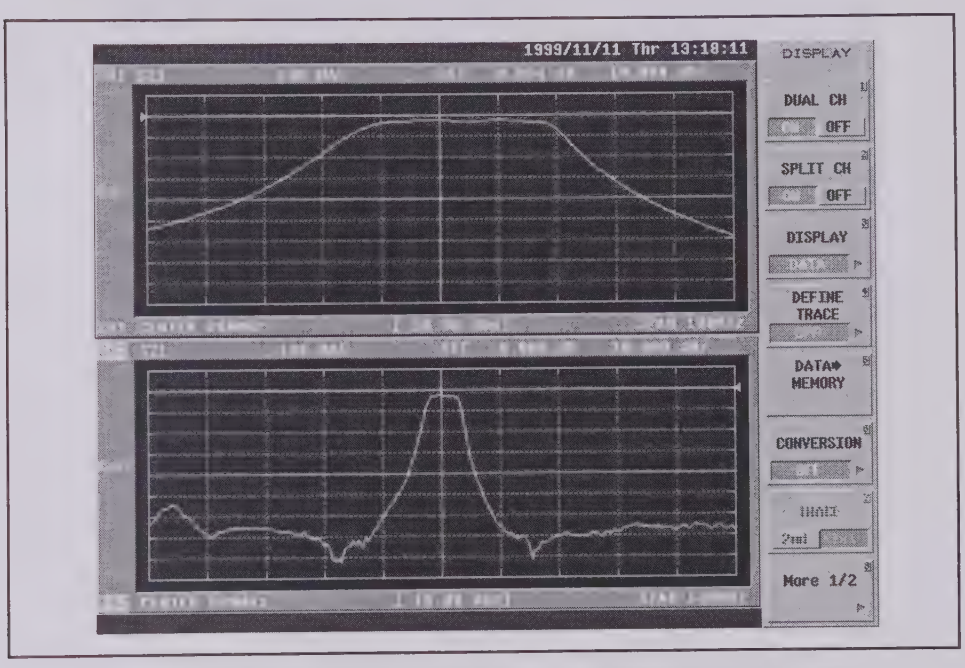


Figure 5-24 Two Channels Simultaneous Display (Split Display)

5.4 Multi-marker List Display

Here explains how to operate multi-marker.

- 880MHz band-pass filter is used as DUT.

① Setup (filter connection) (refer to sub-section 3.5.1) and preset (refer to sub-section 4.4.1).

Press **[CH 2]** to set the active channel to 2.

② Set the center frequency and the span.

[CENTER] → **[8]** → **[8]** → **[0]** → **[MHz]**

[SPAN] → **[2]** → **[0]** → **[0]** → **[MHz]**

③ Calibrate the frequency characteristic.

Remove DUT and connect the through adapter instead.

Normalize in this state.

Following **[CAL]** → *{NORMALIZE (THRU)}*, return the connection to DUT (filter).

④ Display multi-marker.

Maximum 10 markers are displayed in one channel.

A marker is displayed in each calibration marking of the horizontal axis.

[MKR]

{ACTIVATE MARKER[ ]} → *{MARKER 2}* → [↑]

{MARKER 3} → [↑] → [↑]

{MARKER 4} → [↑] → [↑] → [↑]

{MARKER 5} → [↑] → [↑] → [↑] → [↑]

{More 1/2} → *{MARKER 6}* → [↓]

{MARKER 7} → [↓] → [↓]

{MARKER 8} → [↓] → [↓] → [↓]

{MARKER 9} → [↓] → [↓] → [↓] → [↓]

{MARKER 10} → [↓] → [↓] → [↓] → [↓] → [↓]

By the operation in the previous page, the markers are displayed as follows.

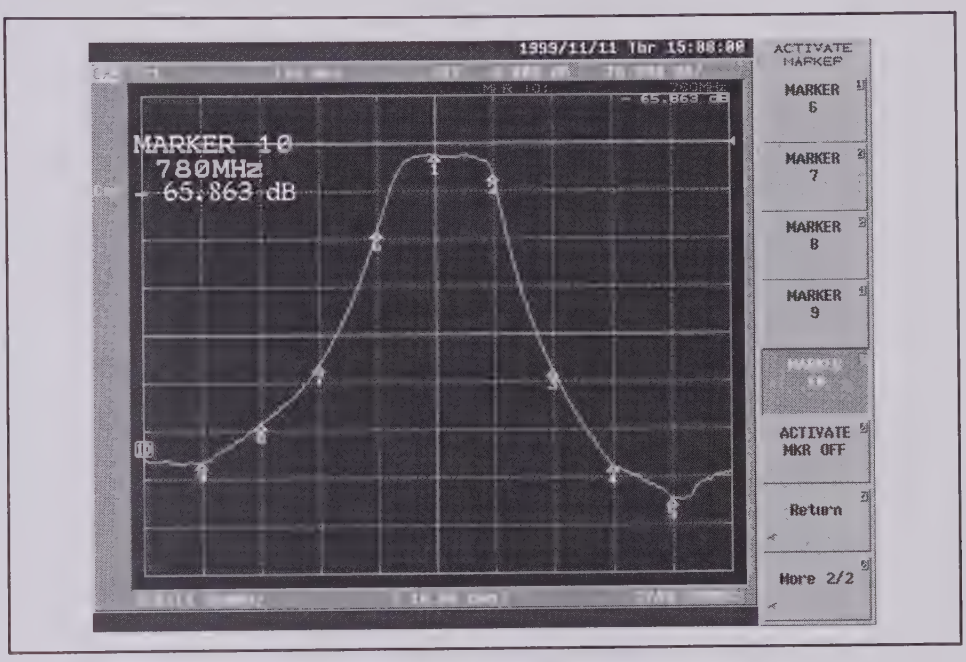


Figure 5-25 Multi-marker Display

⑤ Display marker list.

All the marker data are displayed.

{Return} → *{MKR LIST ON/OFF}*

By the operation above, the marker and the list are displayed as follows.

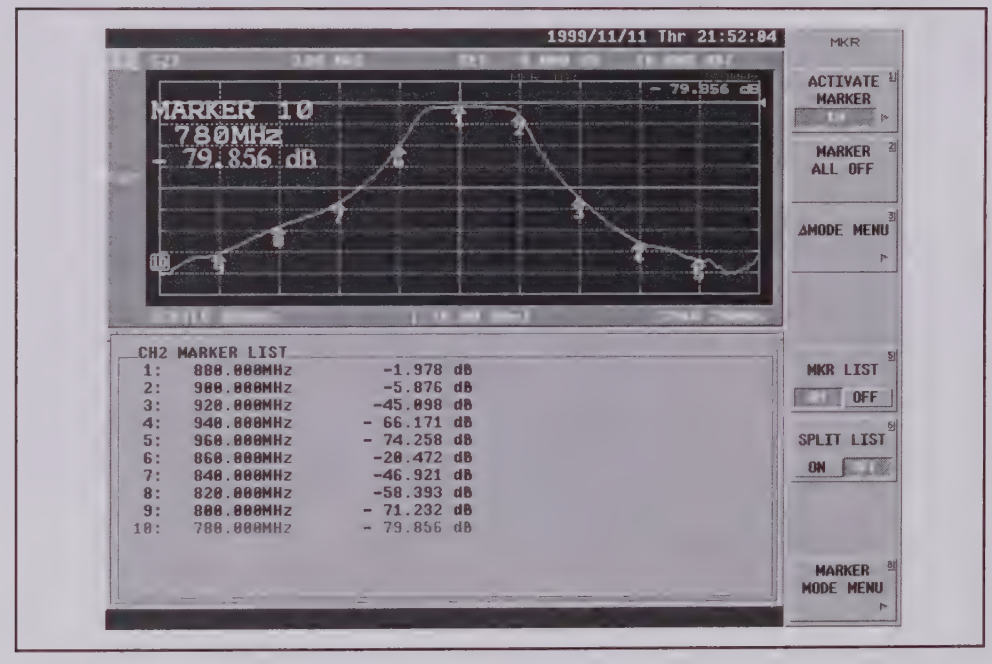


Figure 5-26 Display of Multi-marker List

5.5 Ripple Measurement in the Bandwidth

Here explains how to measure the ripple in the bandwidth.

- 385MHz band-pass filter is used as DUT.

① Setup (filter connection) (refer to sub-section 3.5.1) and preset (refer to sub-section 4.4.1).

Press **[CH 2]** to set the active channel to 2.

② Set the center frequency and the span.

[CENTER] → **[3]** → **[8]** → **[5]** → **[MHz]**

[SPAN] → **[5]** → **[0]** → **[MHz]**

③ Calibrate the frequency characteristic.

Remove DUT and connect the through adapter instead.

Normalize in this state.

[CAL] → *{NORMALIZE (THRU)}*

Following the completion, return the connection to DUT (filter).

④ Set the measurement format to magnitude (log display) and adjust the scale.

[SCALE] → *{AUTO SCALE}*

⑤ Specify a part (delta section).

Specify a delta section.

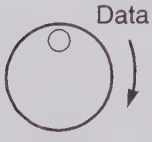
Move marker 1 with the data knob to one end of the specified section.

[MKR]

Set the reference marker to the position of marker 1.

{Δ MODE MENU} → *{Δ REF = Δ MKR}*

Move marker 1 with the data knob to the other end of the specified section.



The area between the reference marker and marker 1 is the delta section.

Specify the delta section as the range of partial search.

[MKR→] → *{PART SRCH [ ]}* → *{SET RANGE}*

Make the partial search effective.

{PART SRCH ON/OFF}

The display on the screen is as follows.

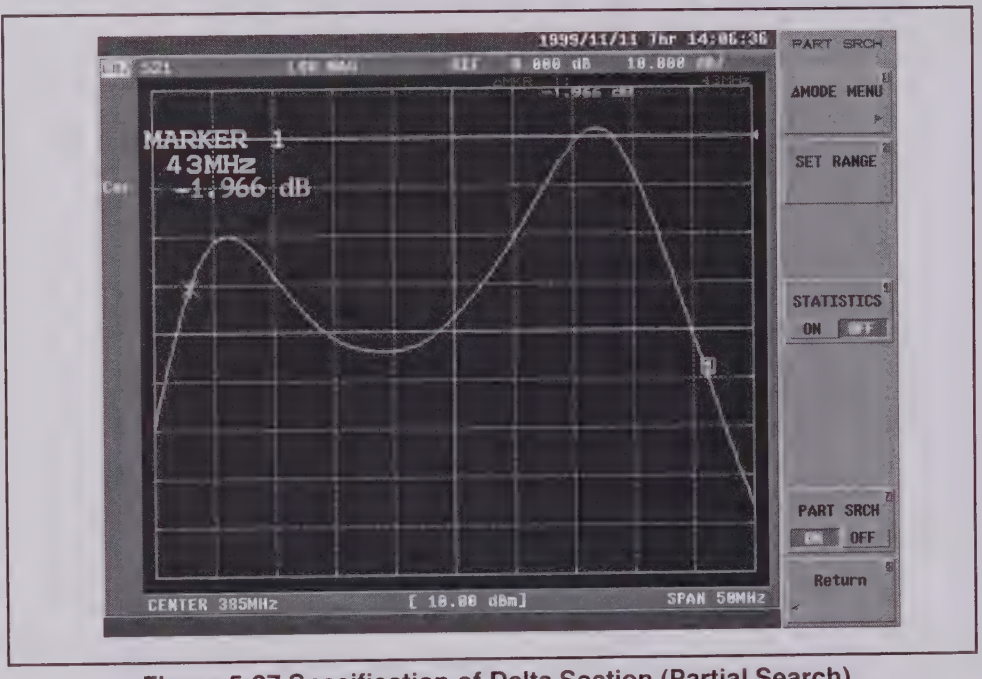


Figure 5-27 Specification of Delta Section (Partial Search)

⑥ Search the maximum value in the delta section.

{Return} → *{MKR SEARCH [ ]}* → *{MAX}*

The display on the screen is as follows.

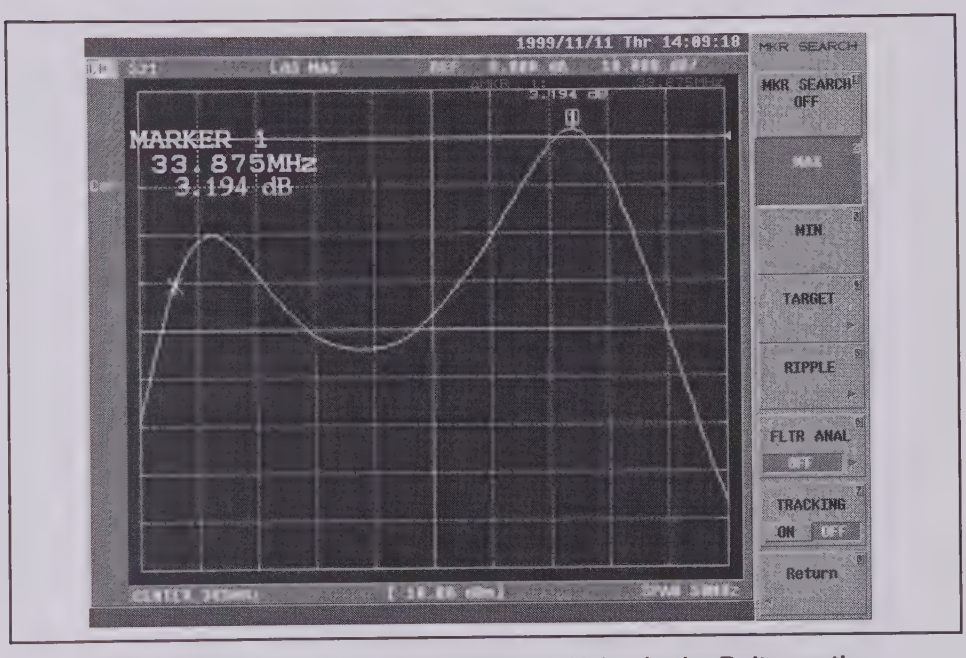


Figure 5-28 Measurement of Maximum Value in the Delta section

⑦ Search the minimum value in the delta section.

{MIN}

The display on the screen is as follows.

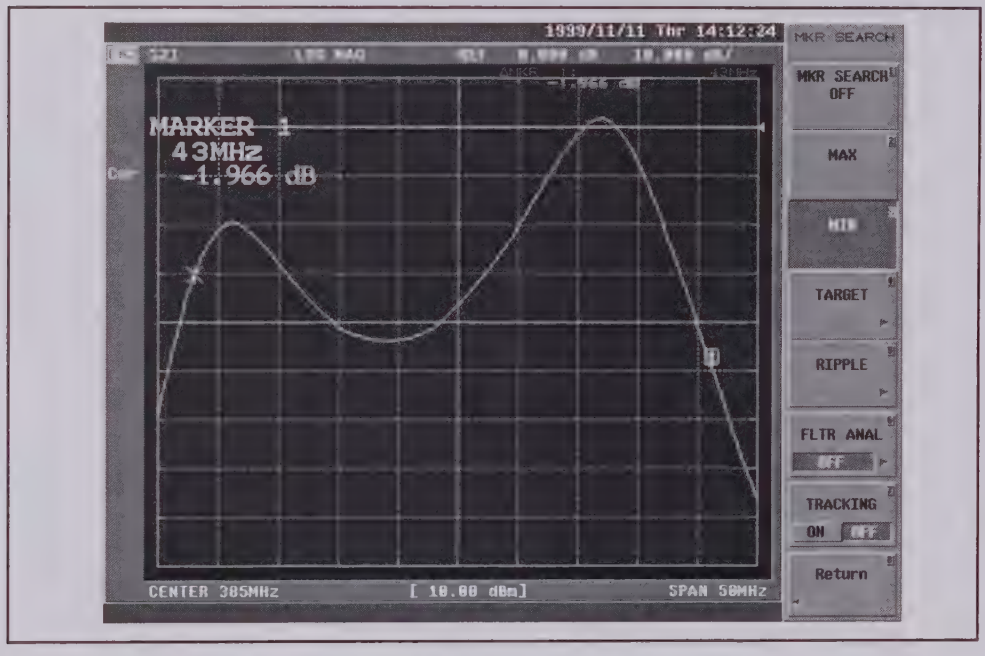


Figure 5-29 Measurement of Minimum Value in the Delta Section

⑧ Search ripple in the delta section.

{RIPPLE} → *{ΔMAX∩-MIN∪}*

The reference marker moves to the most minimum point of the minimum points and the active marker moves to the most maximum point of the maximum points.

The display on the screen is as follows.

The difference of the both marker values is displayed in the active marker area.

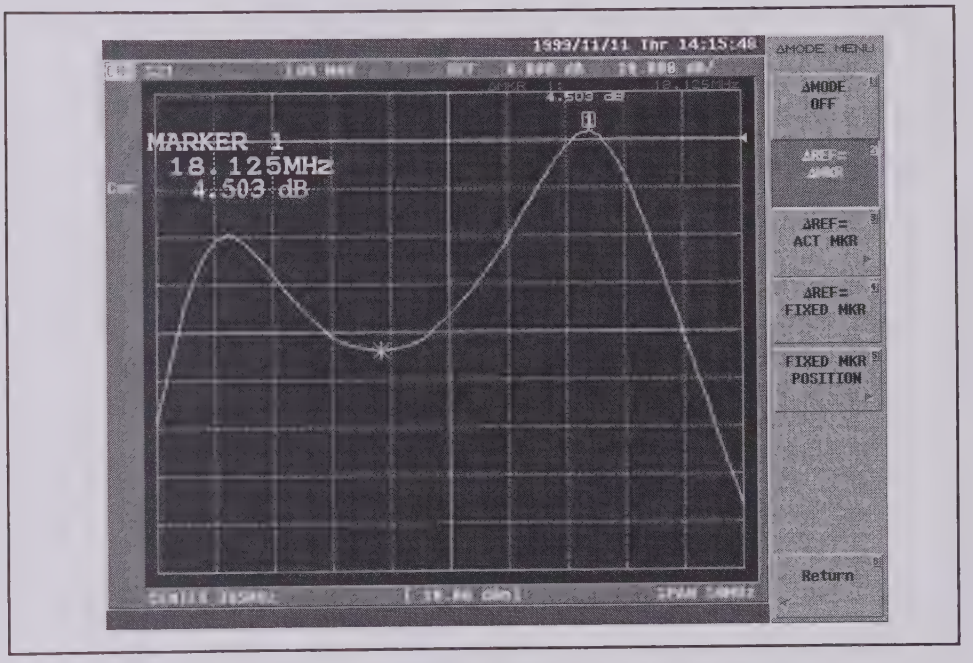


Figure 5-30 Measurement of Ripple in the Delta Section

5.6 Measurement of Electrical Length

Here explains about the measurement of electrical length using correction function of electrical length.

- Cable is used as DUT.

  ① Setup (cable connection) (refer to sub-section 3.5.1) and preset (refer to sub-section 4.4.1).

  Press **[CH 2]** to set the active channel to 2.

  ② Set the start-frequency and the stop-frequency.

  [START] → **[4]** → **[0]** → **[MHz]**

  [STOP] → **[1]** → **[GHz]**

  ③ Calibrate the frequency characteristic.

  Remove DUT and connect the through adapter instead.

  Normalize in this state.

  [CAL] → *{NORMALIZE (THRU)}*

  After the completion, return the connection to DUT (cable).

④ Change the measurement format.

[FORMAT] → *{PHASE}*

The display on the screen is shown in the Figure 5-31.

Thus the phase characteristic shows that DUT has electrical length, by which the phase decreases linearly.

The electrical length of this DUT can be measured by correcting the electrical length.

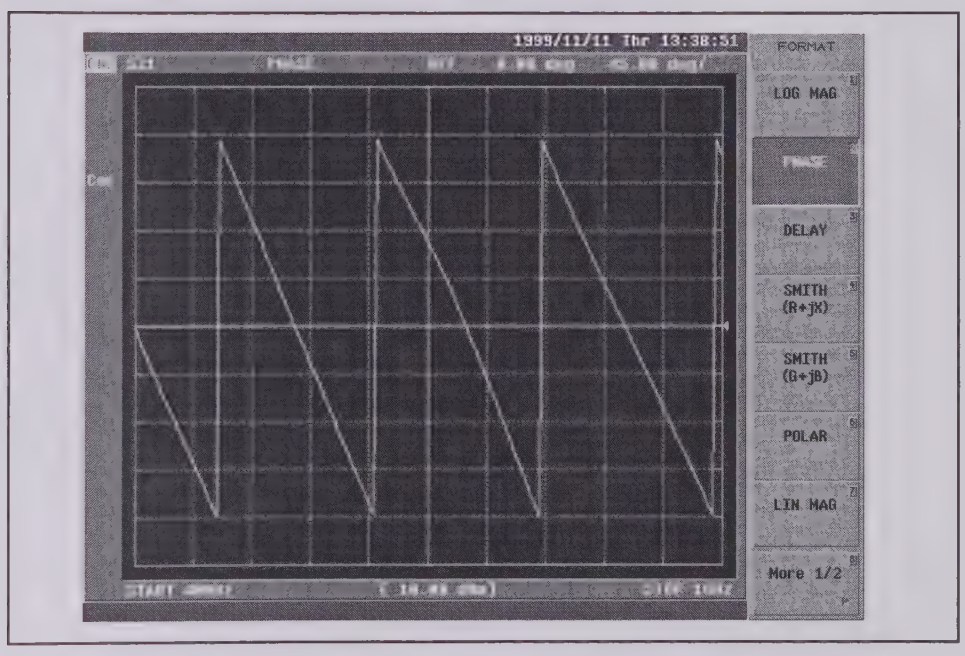


Figure 5-31 Electrical Length of Cable

⑤ Set to electrical length correction mode.

[CAL] → *{More 1/2}* → *{ELEC DELAY ON/OFF}* → *{ELECTRICAL DELAY}*

The display on the screen is as follows.

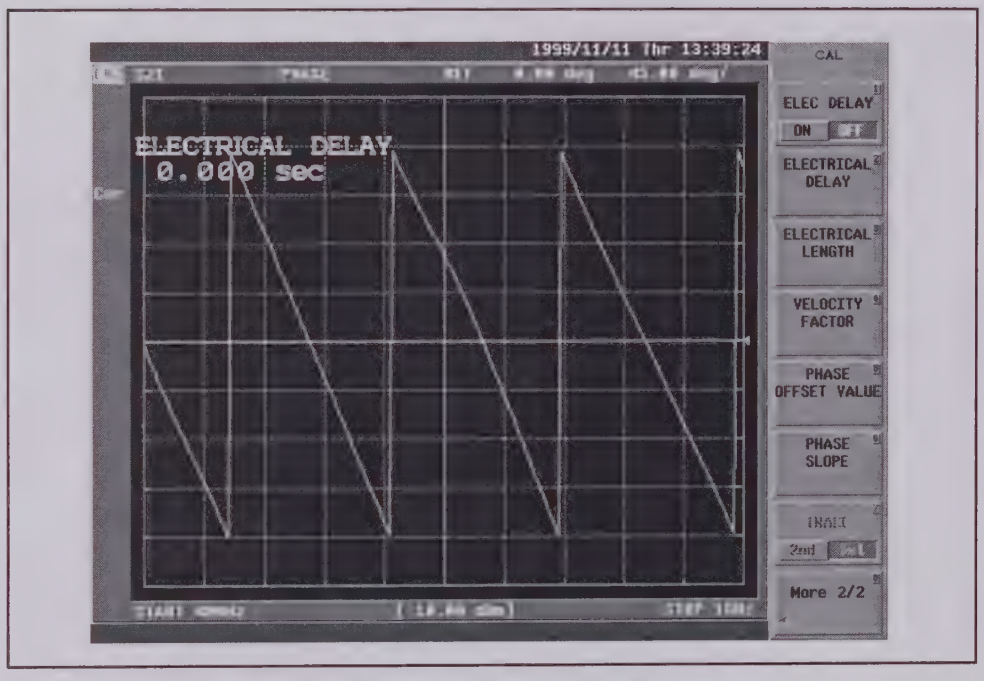


Figure 5-32 Electrical Length Correction Mode

⑥ Correct the electrical length by using the phase characteristic until the phase characteristic becomes flat.

(It may be necessary to turn the knob several times until the phase characteristic becomes flat.)

This correction value is the electrical length of DUT.

Data knob

The display on the screen is as follows.

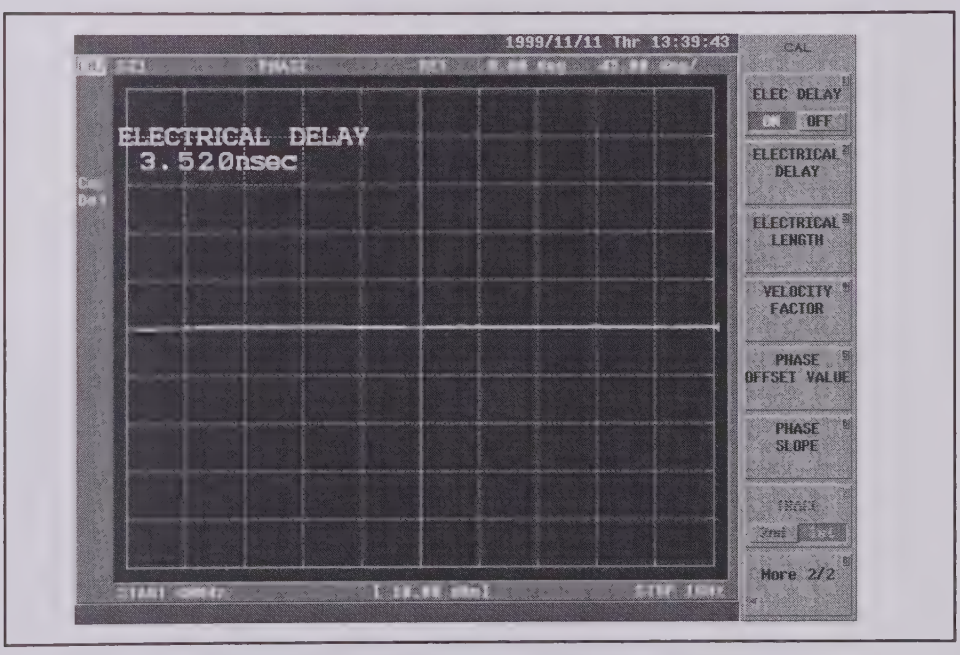


Figure 5-33 Measurement of Electrical Length

5.7 High-speed Measurement Using the Program Sweep Function

Here explains about the program sweeping function that can execute sweeping according to the list of already specified sweeping segment.

This function is useful to shorten measurement time or to improve dynamic range.

- 880MHz band-pass filter is used as DUT.

① Setup (filter connection) (refer to sub-section 3.5.1) and preset (refer to sub-section 4.4.1).

Press **[CH 2]** to set the active channel to 2.

② Set start-frequency and stop-frequency.

[CENTER] → **[8]** → **[8]** → **[0]** → **[MHz]**

[SPAN] → **[2]** → **[0]** → **[0]** → **[MHz]**

③ Set the measurement format to magnitude (log display).

[FORMAT] → *{LOG MAG}*

Calibration is performed following the completion of program sweeping edition.

The display on the screen is as follows.

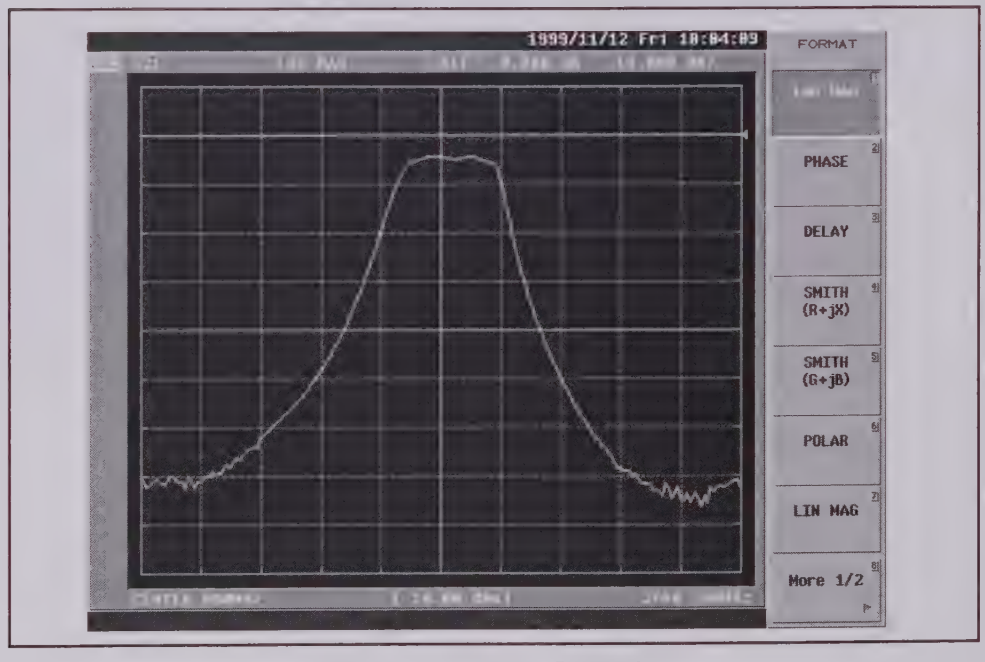


Figure 5-34 Linear Sweeping

- Next, enlarge and measure the specified bandwidth about this filter by using program sweep.

  Here, divide the pass-band into the following three segments to enlarge and measure.

SEG.	START	STOP	POINT
0	800MHz	840MHz	50
1	865MHz	900MHz	50
2	920MHz	960MHz	50

  Each sweep segment (SEG.) is independent so that different sweeping point number, power level value and IF bandwidth value can be setup.

  Program sweep function allows to sweep up to all sweeping point 1201 at a time and connect up to 30 kinds of these segment sweep settings (SEG.NUMBER 0 to 29).

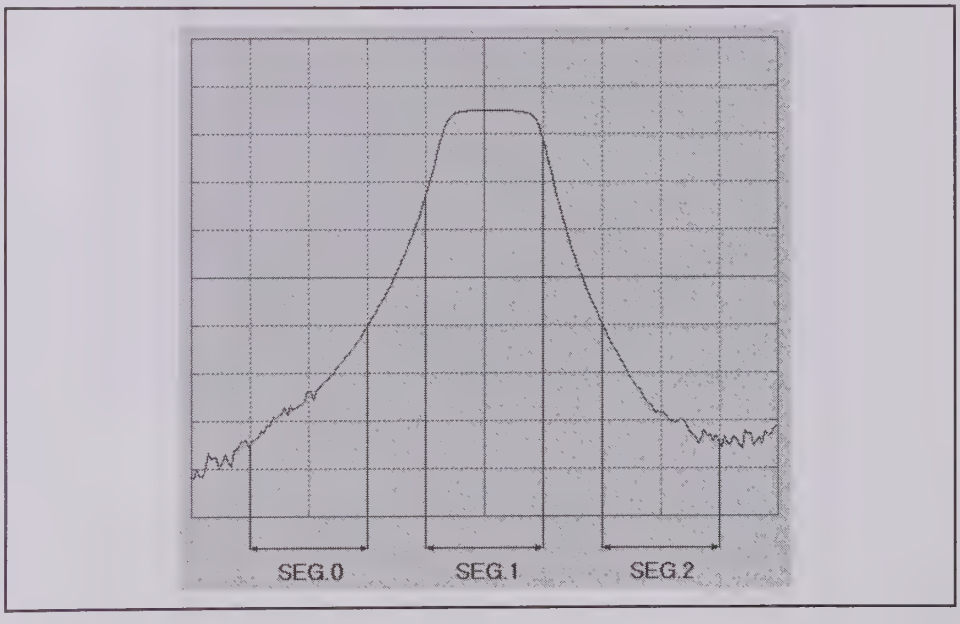


Figure 5-35 Setting of Program Sweeping

④ Edit each setup value of the program sweep.
For the divided three segments, setup the data in 0, 1 and 2 segments.

[MENU] → *{SWEEP TYPE [ ]}* → *{EDIT PROG SWEEP}*
{SEGMENT NUMBER} → **[0]** → **[X1]**
{START} → **[8]** → **[0]** → **[0]** → **[MHz]**
{STOP} → **[8]** → **[4]** → **[0]** → **[MHz]**
{POINT} → **[5]** → **[0]** → **[X1]**

{SEGMENT NUMBER} → **[1]** → **[X1]**
{START} → **[8]** → **[6]** → **[5]** → **[MHz]**
{STOP} → **[9]** → **[0]** → **[0]** → **[MHz]**
{POINT} → **[5]** → **[0]** → **[X1]**

{SEGMENT NUMBER} → **[2]** → **[X1]**
{START} → **[9]** → **[0]** → **[2]** → **[MHz]**
{STOP} → **[9]** → **[6]** → **[0]** → **[MHz]**
{POINT} → **[5]** → **[0]** → **[X1]**

⑤ Set the sweep type to the program sweep.
Press *{Return}* → *{PROGRAM SWEEP}*.

⑥ Calibrate frequency characteristic.

Remove DUT and connect the through adapter instead.

Normalize in this state.

[CAL] → *{NORMALIZE (THRU)}*

Following the completion, return the connection to DUT (filter).

The display on the screen is as follows.

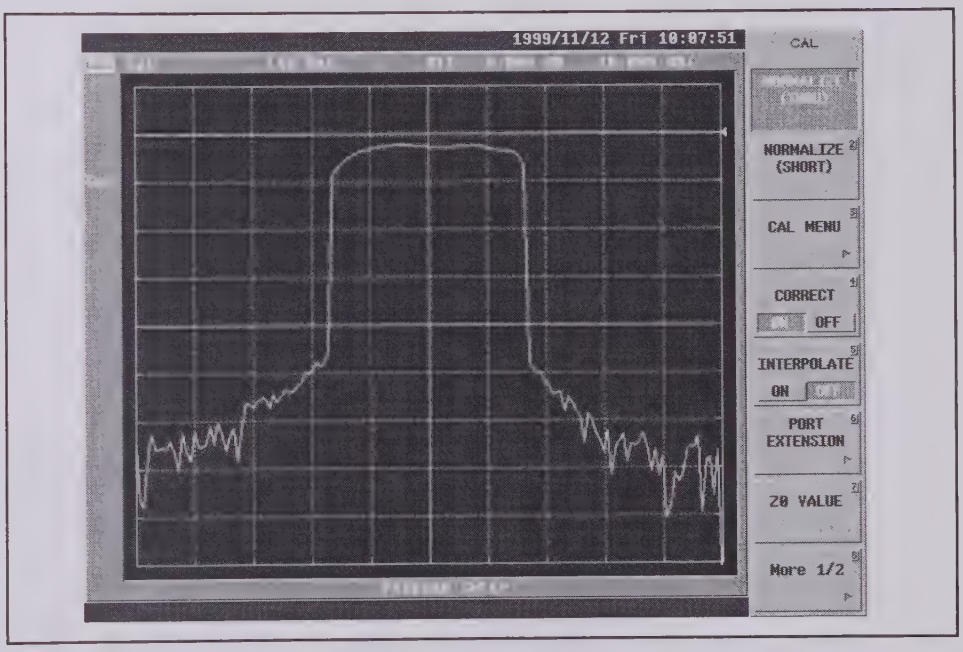


Figure 5-36 Execution of the Program Sweep

⑦ In the program sweep, the power level value and IF bandwidth value can be set in each segment.

Therefore the measurement is possible to improve the analyzer's dynamic range.

Set IF bandwidth of segment 0 to 1kHz and power level of segment 1 to +5.0dBm, here.

[MENU] → *{SWEEP TYPE [ ]}* → *{EDIT PROG SWEEP}*

{SEGMENT NUMBER} → **[0]** → **[X1]**

{More 1/2}

{IF RBW} → **[1]** → **[kHz]**

{More 2/2}

{SEGMENT NUMBER} → **[1]** → **[X1]**

{More 1/2}

{SEGMENT POWER} → **[5]** → **[.]** → **[0]** → **[X1]**

{Return}

{PROGRAM SWEEP}

The display on the screen is as follows.

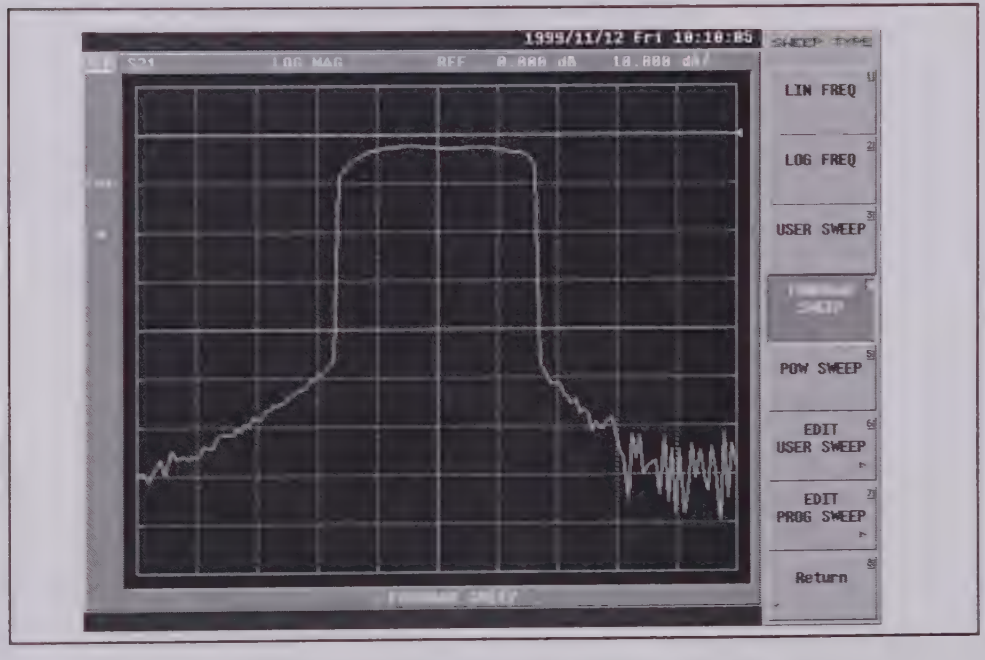


Figure 5-37 Change of the Program Sweep

5.8 GO/NG Measurement Using Limit Line Function

GO/NG of DUT can be judged by using the limit line function of the R3765/67G series.

Besides the judgement of magnitude, GO/NG of Smith chart and Polar coordinates display can be judged.

- The following shows an example of how the limit line of 880MHz band-pass filter is generated.

  Setting procedure

  ① Setup (filter connection) (refer to sub-section 3.5.1) and preset (refer to sub-section 4.4.1).

  Press **[CH 2]** to set the active channel to 2.

  ② Setup start-frequency and stop-frequency.

  [CENTER] → **[8]** → **[8]** → **[0]** → **[MHz]**

  [SPAN] → **[1]** → **[0]** → **[0]** → **[MHz]**

  ③ Calibrate the frequency characteristic.

  Remove DUT and connect the through adapter instead.

  Normalize in this state.

  Following the completion of **[CAL]** → *{NORMALIZE (THRU)}*, return the connection to DUT.

  ④ Set the measurement format to magnitude (log display).

  The display on the screen is as follows.

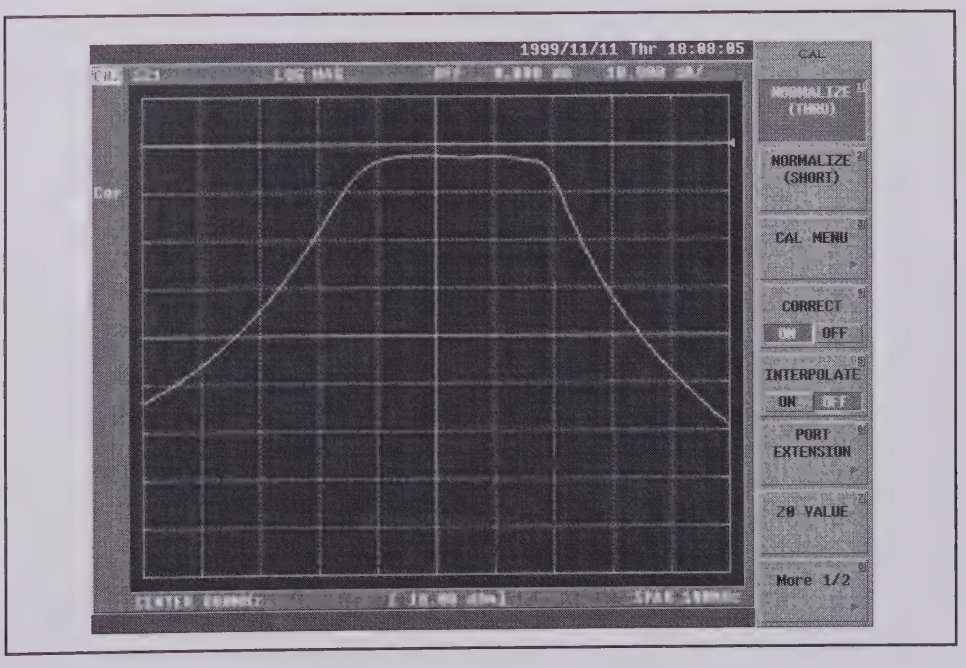


Figure 5-38 Screen before Execution of Limit Line Measurement

⑤ Set limit line.

Limit line is set the upper limit value and the lower limit line for each segment. The segment can be setup to 31 pcs.(0 to 30)

Here generates the limit line of the following table.

SEGMENT No.	0	1	2	3	4
Stimulus value	830MHz	840MHz	865MHz	900MHz	920MHz
Upper limit value	-40dB	-40dB	0dB	0dB	-40dB
Lower limit value	-65dB	-65dB	-20dB	-20dB	-65dB

The following figure shows the limit line to set.

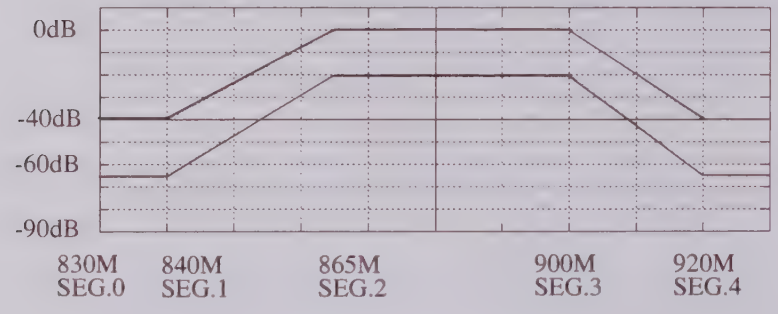


Figure 5-39 Setting of the Limit Line

- Establish the edit mode.

  [SYSTEM] → *{LIMIT MENU}* → *{EDIT LIMIT LINE}*

  The display on the screen is as follows.

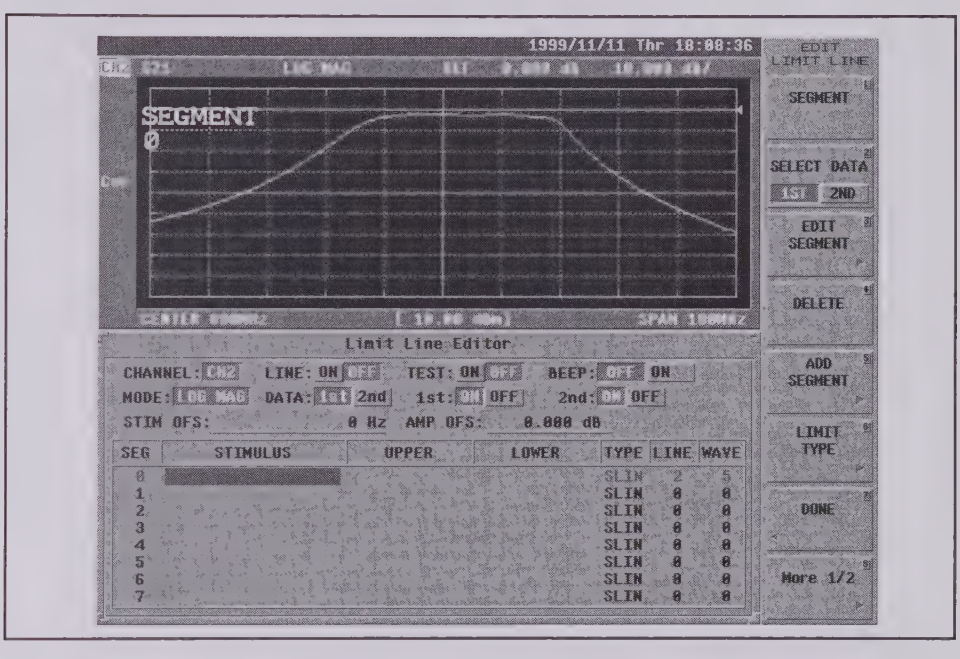


Figure 5-40 Limit Line Editing

- Set each segment.

  Setting of segment 0.

  SEGMENT 0 : *{EDIT SEGMENT}*

  {STIMULUS VALUE} → **[8]** → **[3]** → **[0]** → **[MHz]**

  {UPPER LIMIT} → **[-]** → **[4]** → **[0]** → **[X1]**

  {LOWER LIMIT} → **[-]** → **[6]** → **[5]** → **[X1]**

  {Return}

  As the marker can be used with data knob, etc. now, it's useful to confirm the setting value of each segment.

The display on the screen is as follows.

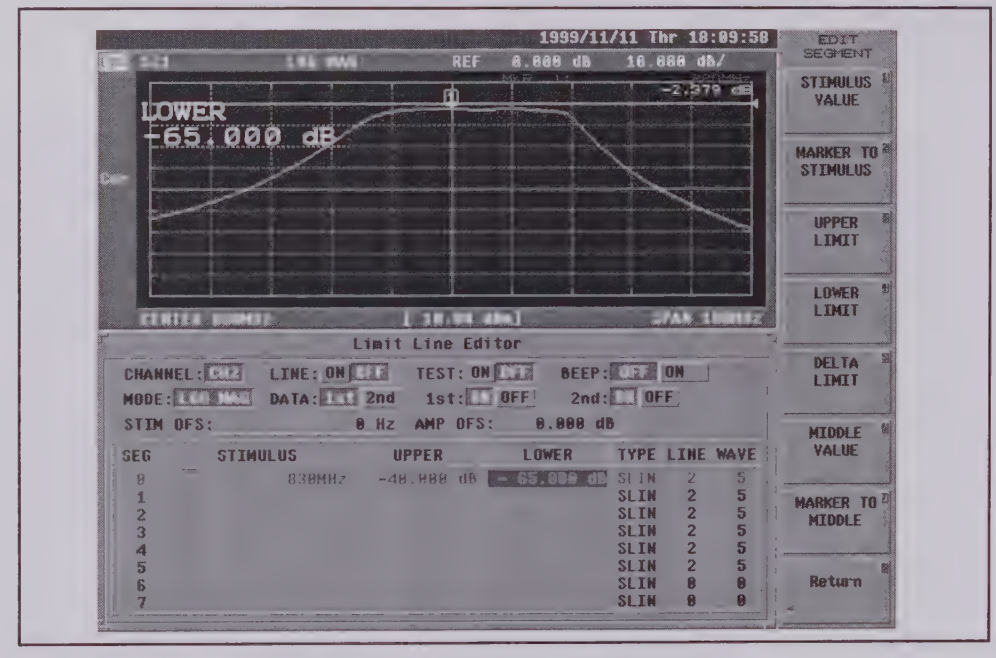

1999/11/11 Thr 18:09:58
REF 0.000 dB 10.000 dB/
LOWER
-65.000 dB
EDIT SEGMENT
STIMULUS VALUE
MARKER TO STIMULUS
UPPER LIMIT
LOWER LIMIT
DELTA LIMIT
MIDDLE VALUE
MARKER TO MIDDLE
Return
Limit Line Editor
CHANNEL: CH2 LINE: ON OFF TEST: ON OFF BEEP: OFF ON
MODE: LOW MAX DATA: 1st 2nd 1st: OFF 2nd: OFF
STIM OFS: 0 Hz AMP OFS: 0.000 dB
SEG STIMULUS UPPER LOWER TYPE LINE WAVE
0 830MHz -40.000 dB -65.000 dB SLIN 2 5
1 SLIN 2 5
2 SLIN 2 5
3 SLIN 2 5
4 SLIN 2 5
5 SLIN 2 5
6 SLIN 0 0
7 SLIN 0 0

Figure 5-41 Setting of Segment 0

Set segment 1, segment 2, segment 3 and segment 4 in the same way.

SEGMENT 1 : *{ADD SEGMENT}*
{STIMULUS VALUE} → **[8]** → **[4]** → **[0]** → **[MHz]**
{UPPER LIMIT} → **[-]** → **[4]** → **[0]** → **[X1]**
{LOWER LIMIT} → **[-]** → **[6]** → **[5]** → **[X1]**
{Return}

SEGMENT 2 : *{ADD SEGMENT}*
{STIMULUS VALUE} → **[8]** → **[6]** → **[5]** → **[MHz]**
{UPPER LIMIT} → **[0]** → **[X1]**
{LOWER LIMIT} → **[-]** → **[2]** → **[0]** → **[X1]**
{Return}

SEGMENT 3 : *{ADD SEGMENT}*
{STIMULUS VALUE} → **[9]** → **[0]** → **[0]** → **[MHz]**
{UPPER LIMIT} → **[0]** → **[X1]**
{LOWER LIMIT} → **[-]** → **[2]** → **[0]** → **[X1]**
{Return}

SEGMENT 4 : *{ADD SEGMENT}*
{STIMULUS VALUE} → **[9]** → **[2]** → **[0]** → **[MHz]**
{UPPER LIMIT} → **[-]** → **[4]** → **[0]** → **[X1]**
{LOWER LIMIT} → **[-]** → **[6]** → **[5]** → **[X1]**
{Return}

The display on the screen is as follows.

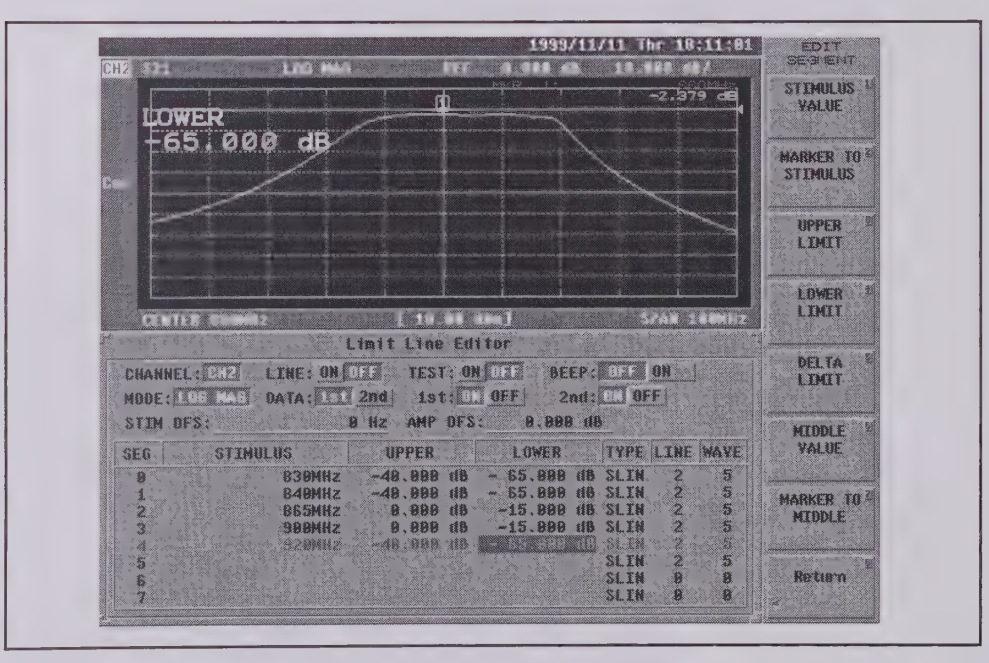

1999/11/11 Thr 10:11:01
LOWER
-65.000 dB
-2.379 dB
Limit Line Editor
CHANNEL: CH2 LINE: ON OFF TEST: ON OFF BEEP: OFF ON
MODE: LOG MAG DATA: 1st 2nd 1st: ON OFF 2nd: ON OFF
STIM OFS: 0 Hz AMP OFS: 0.000 dB
SEG STIMULUS UPPER LOWER TYPE LINE WAVE
0 830MHz -40.000 dB - 65.000 dB SLIN 2 5
1 840MHz -40.000 dB - 65.000 dB SLIN 2 5
2 865MHz 0.000 dB -15.000 dB SLIN 2 5
3 900MHz 0.000 dB -15.000 dB SLIN 2 5
5 SLIN 2 5
6 SLIN 0 0
7 SLIN 0 0
EDIT SEGMENT
STIMULUS VALUE
MARKER TO STIMULUS
UPPER LIMIT
LOWER LIMIT
DELTA LIMIT
MIDDLE VALUE
MARKER TO MIDDLE
Return

Figure 5-42 Setting of Each Segment

- Select a display type of limit line from the following 3 types for each segment.
  [1] SLOPING LINE (SLIN) : Links to the next segment with a straight-line.
  [2] FLAT LINE (FLIN) : Links to the next segment with horizontal lines.
  [3] SINGLE POINT (SPO) : Shows each segment with a point.
  In the above example, the type is not set as it's linked with SLOPING LINE of default.
  For example, to set Segment 1, use the procedure shown below.
  {SEGMENT} → **[1]** → **[X1]**
  {LIMIT TYPE} → *{FLAT LINE}*
  {Return}

⑥ Define the setting of limit line and return to the edit menu.
{DONE}

⑦ Switch ON the GO/NG judgement.
{LIMIT TEST ON/OFF}

⑧ Switch ON the limit line.
{LIMIT LINE ON/OFF}
The display on the screen is as follows.

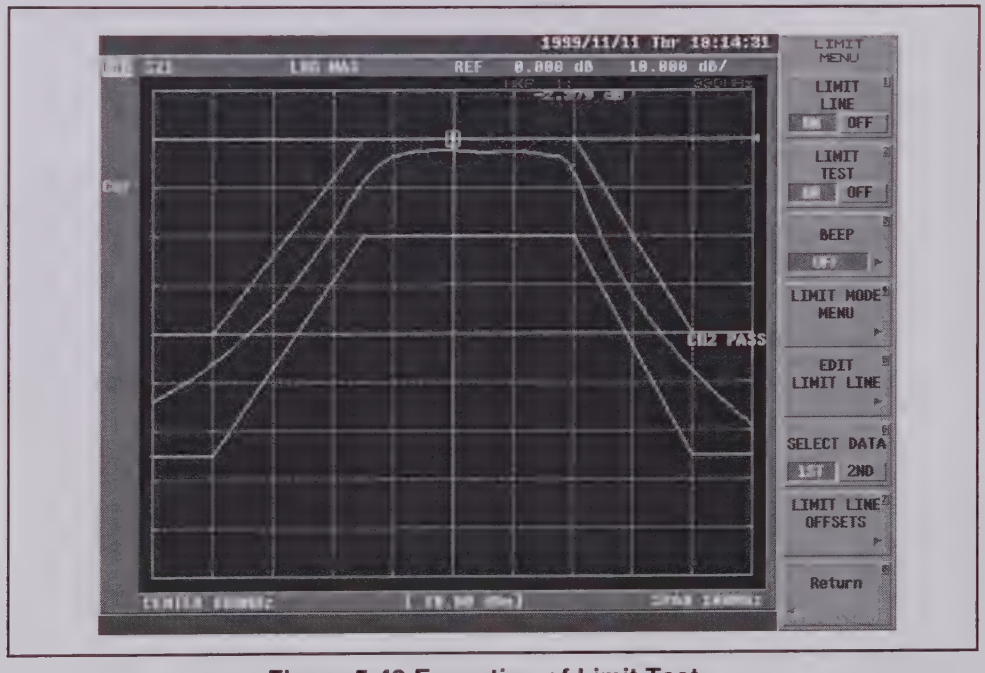


Figure 5-43 Execution of Limit Test

⑨ Change the lower limit values of segment 2 and segment 3 to -20dB.

{EDIT LIMIT LINE}

{SEGMENT} → **[2]** → **[X1]** → *{EDIT SEGMENT}*

{LOWER LIMIT} → **[-]** → **[1]** → **[5]** → **[X1]**

{Return}

{SEGMENT} → **[3]** → **[X1]** → *{EDIT SEGMENT}*

{LOWER LIMIT} → **[-]** → **[1]** → **[5]** → **[X1]**

{Return}

{DONE}

The display on the screen is as follows.

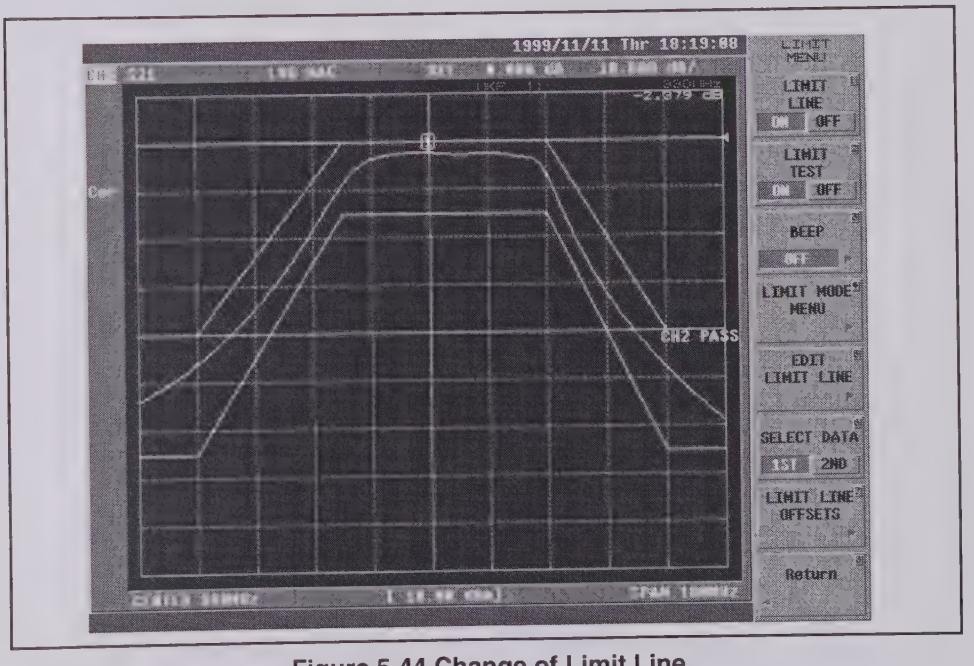


Figure 5-44 Change of Limit Line

6 RECORD and OUTPUT

This chapter describes how to output the measurement data to the plotter, how to save it into the floppy disk and how to recall it.

6.1 Output of Measured Data to the Plotter

Here explains how to output the measurement data to the plotter.

- It's assumed that the plotter is set in HP mode and the address is set to 5.

① Display the markers, etc. and set the measurement screen to plot.

② In order to use the plotter, set the R3765/67G series to SYSTEM CONTROLLER.
[LCL] → *{SYSTEM CONTROLLER}*

③ Set GPIB address of the plotter to the R3765/67G series.
{SET ADDRESS} → *{ADDRESS PLOTTER}* → **[5]** → **[X1]**

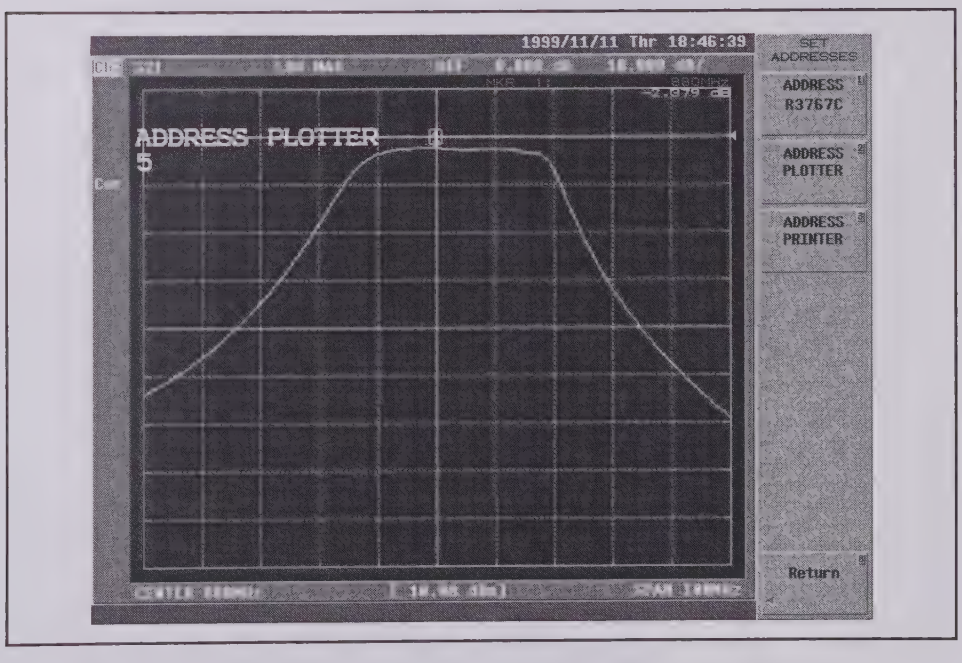


Figure 6-1 Setting of Plotter GPIB Address

④ Select the mode of the plotter.

The plotter is initial-set in HP mode.

Set the plotter of the R3765/67G series to HP mode too.

[COPY] → *{PRINT/PLOT SETUPS}*

{DEFAULT SETUPS}

{PLOTTER}

{HP} Select HP.

{Return}

⑤ Select the data to output to the plotter.

The following is set here.

- Output measurement data, coordinates data, text data, marker data, reference data.
- Memory data is not output.

All initial values are set to "ON" (output).

Only memory data is set to "OFF" (not output).

{DEFINE PLOT}

{PLOT MEMORY ON/OFF} Switch OFF.

Above operation displays the screen as shown in Figure 6-2.

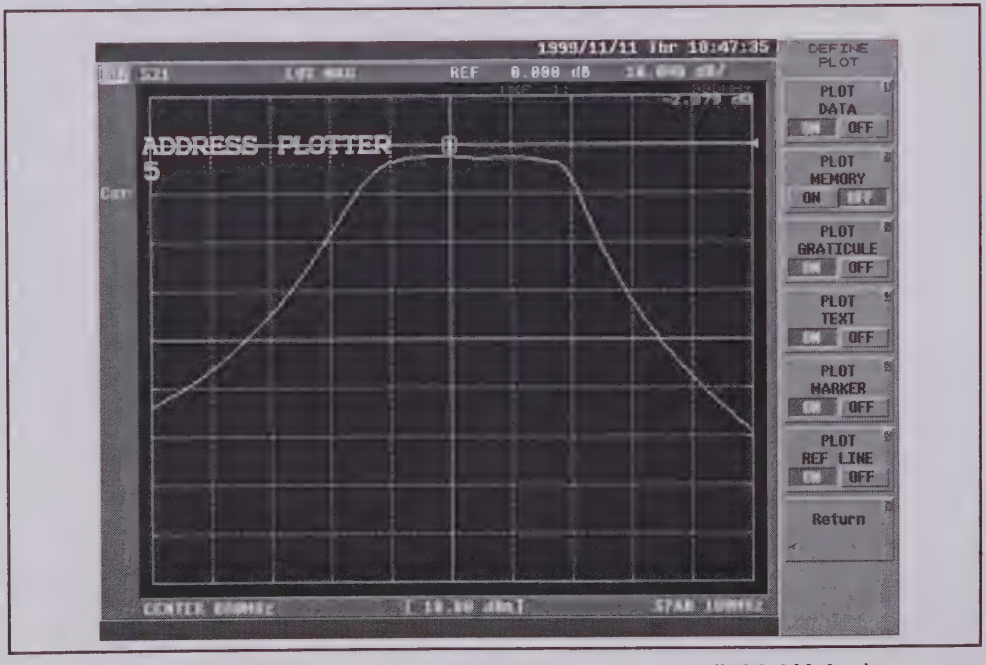


Figure 6-2 Change of Plotter Initial Setup Value (Initial Value)

⑥ Start the output to the plotter.
{Return} → *{PLOT}*

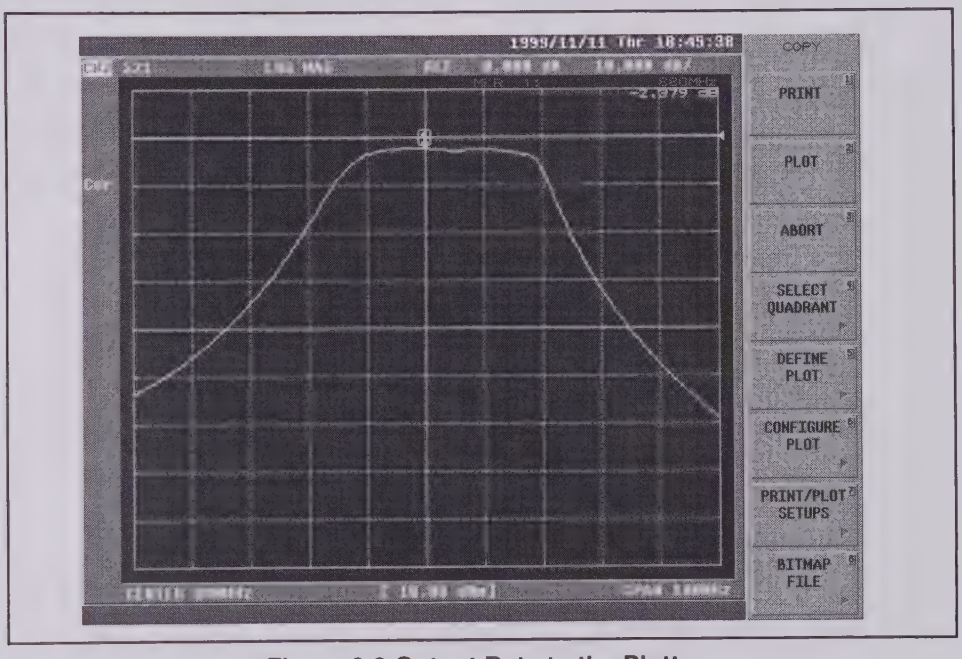


Figure 6-3 Output Data to the Plotter

⑦ The output result of the plotter is as follows.

Note : HP plotter sometimes makes error display such as the error lamp lights with normal plotting.

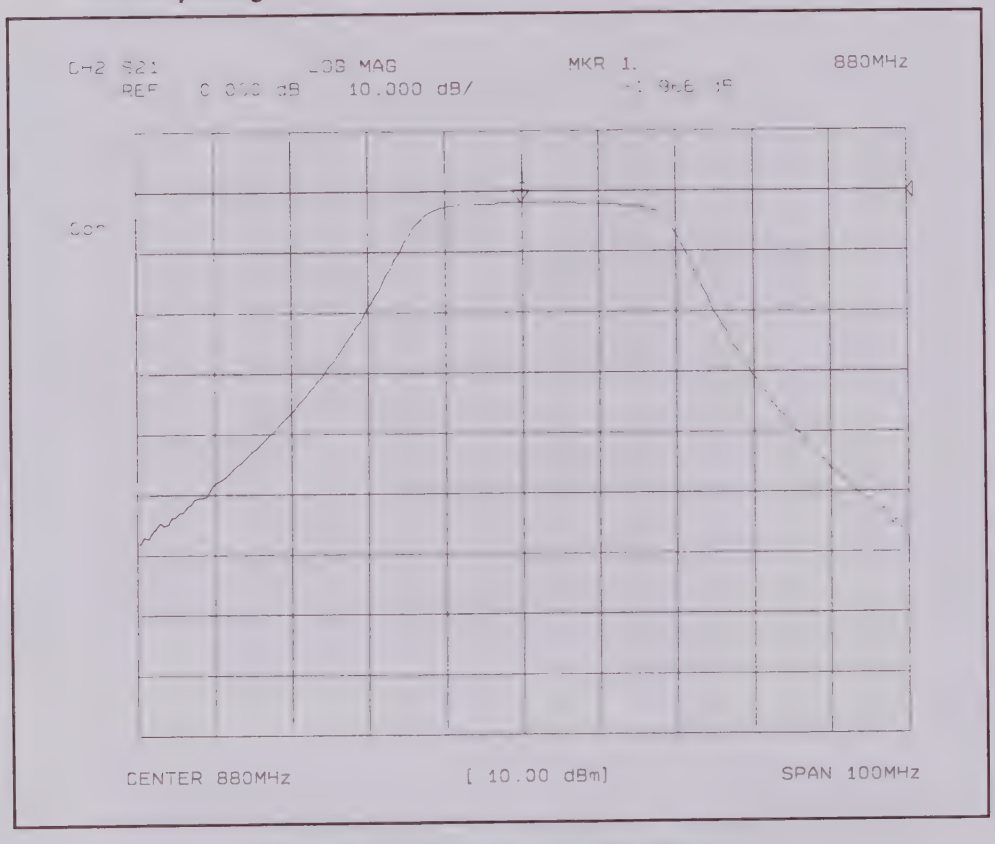


Figure 6-4 Output Result of the Plotter

6.2 Using the Save/Recall Register

Here describes how to save/recall the setting of the measurement to the save/recall-register.

(1) Saving into the save-register

① Set the measurement screen to save by displaying the markers, etc.

② Save the setting in the save-register.

[SAVE] → *{SAVE REGISTER}* → *{SAVE REG-1}*

By the above operation, the display on the screen changes as follows.

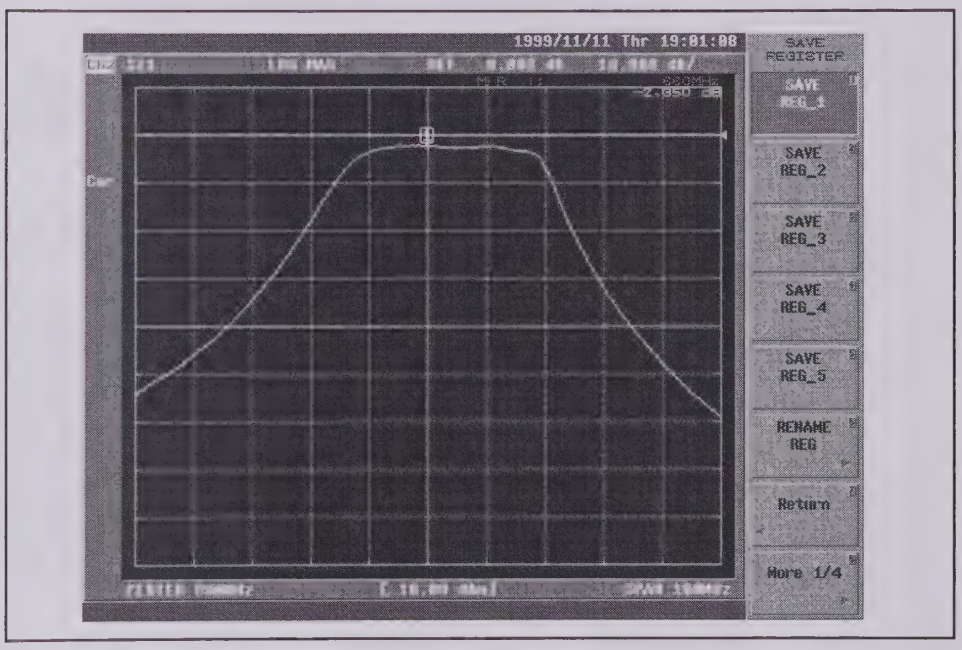


Figure 6-5 Saving into the Save-Register

(2) Recalling from the recall-register

① Execute the preset and initialize the setting of the R3765/67G series.

[PRESET]

② Recall the setting by the recall-register.

[RECALL] → *{RECALL REG-1}*

By the above operation, the display on the screen changes as follows.

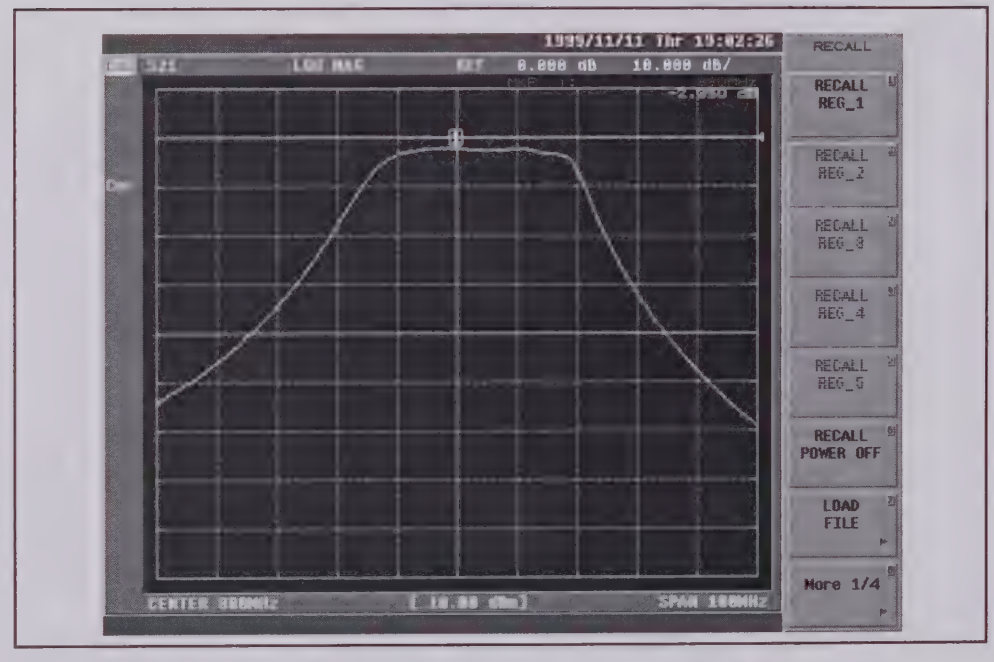


Figure 6-6 Recalling from the Recall-register

CAUTION!

1. ***When the saving is performed to the save-register, the setting and the calibration data are saved in C drive (RAM disk, with backed up), and the memory trace data is saved in B drive (RAM disk, without backed up).***
   Therefore, the memory trace data is cleared at power source OFF.
2. ***In order to save the memory trace data, use the store file function for saving to the floppy disk in the section 6.3. Refer to section 7.12 for details.***

6.3 Saving to the Floppy Disk

Here describes how to save/recall the setting of the measurement using the store/load-file.

In the store/load-file, the data is stored in the floppy disk inserted in A drive.

CAUTION!

1. ***Have a formatted floppy disk ready.***
2. ***The usable disks are DD720KB, HD1.2MB, HD1.44MB.***

(1) Formatting procedure of floppy disk

① Insert floppy disk into floppy disk drive.

Format types in the initial state are ;

2HD 1.44MB

② Format.

[SAVE] → *{FORMAT DISK}* → *{OK?}*

(2) Saving to the floppy disk

① Display markers, etc. and set the measurement screen to save.

② Insert the formatted floppy disk into A drive and select the store file menu.

After floppy disk inserted,

[SAVE] → *{STORE FILE}*

Now the file list window is displayed.

③ Select a data to store.

The setting conditions, raw data before formatted and calibration data are stored here.

{DEFINE STORE}

{STATE ON/OFF}
{RAW ARRAY ON/OFF} ┐ Switch ON.

{CORR COEF ON/OFF} When the calibration was performed, switches ON automatically.

{Return}

④ Set a name to a file before saving the data to retrieve easily.

If it's saved under the default file name, see step ⑤.

{EDIT NAME}

{CLEAR NAME}

⑤ The file name is saved as "TEST".

(a) Put the cursor on the "T" with the data knob or [↑] [↓], and press **[X1]**.

(b) Put the cursor on the "E" with the data knob or [↑] [↓], and press **[X1]**.

(c) Put the cursor on the "S" with the data knob or [↑] [↓], and press **[X1]**.

(d) Put the cursor on the "T" with the data knob or [↑] [↓], and press **[X1]**.

By the above operation, the display on the screen becomes as follows.

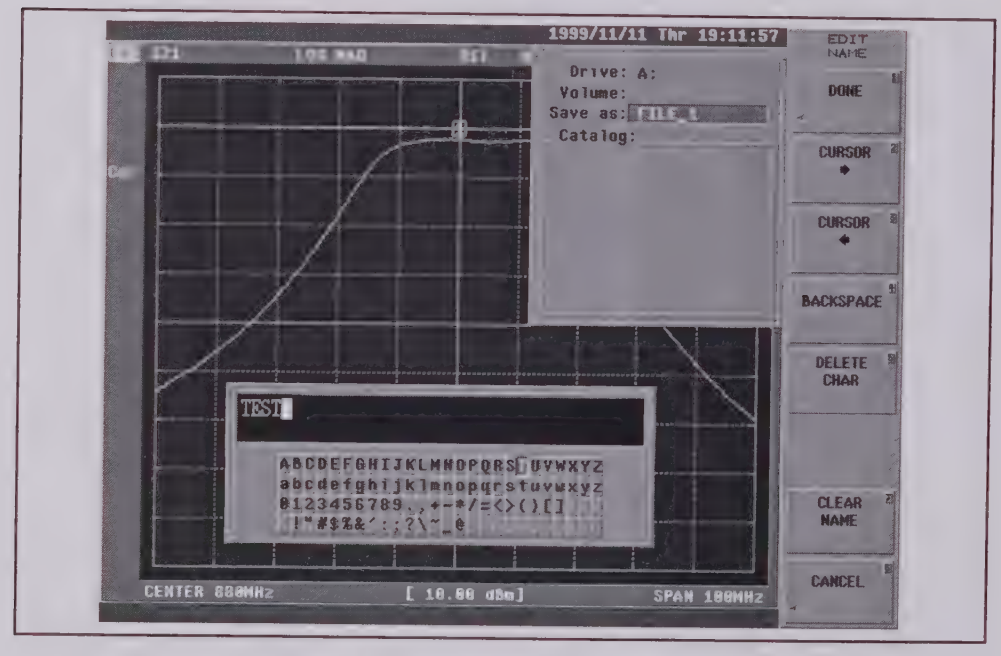


Figure 6-7 Saving to the Floppy Disk

File name is defined with *{DONE}*.

⑥ Save.

{STORE}

With the above operation, the data saving is completed.

(3) Recall from floppy disk

① Execute the preset and initialize the setting of the R3765/67G series.

[PRESET]

② Recall the saved data from the file.

[RECALL] → *{LOAD FILE}*

Now the file list window is displayed.

③ Select the file name to recall from the file list (refer to Figure 7-5), and execute the recall of data.

Put the cursor on the file to recall with *{CURSOR↑}* and *{CURSOR↓}*.

By *{LOAD}* the display on the screen becomes as follows.

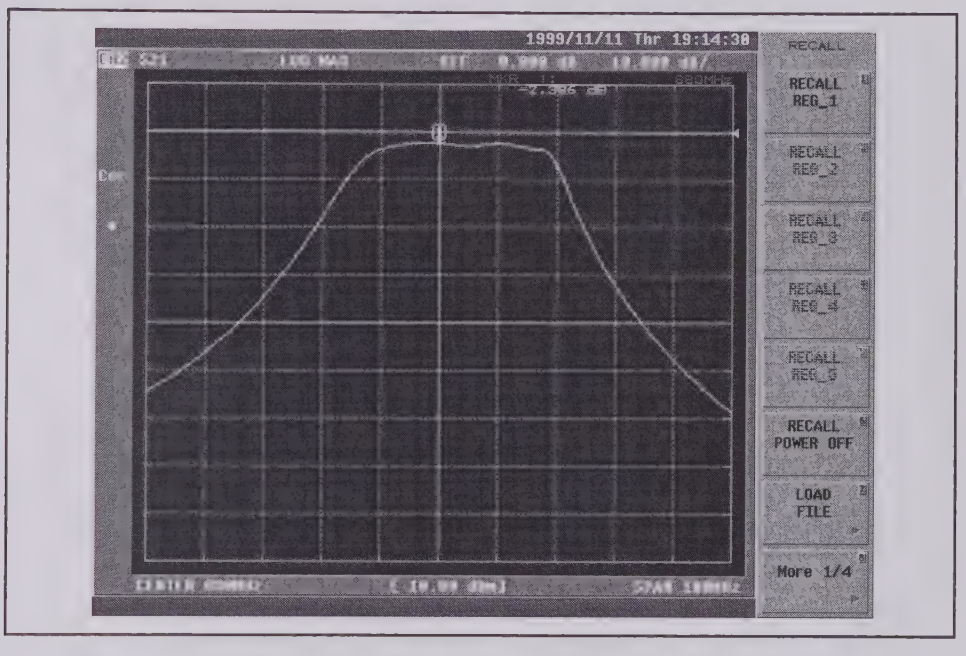


Figure 6-8 Recall from Floppy Disk

After the completion of the recall, the sweep is in the held state automatically.

6.3.1 About the Measurement Data to Save

There are three kinds in the measurement data to save.

(1) RAW ARRAY (Raw data)

(2) FORMAT ARRAY (Format data)

(3) MEM ARRAY (Memory data)

Now (1) RAW ARRAY and (2) DATA ARRAY save the display data.

The difference between the two data is as follows.

- RAW ARRAY saves the data before the error correction, the trace computation, etc. processed.
- DATA ARRAY saves the displayed data itself.

For example, when the saved data is recalled by RAW ARRAY, the right value when saved can be displayed even if the measurement format is changed.

In DATA ARRAY, if the displayed format when saved is of LOG MAG setting, the right value is displayed only with LOG MAG format at the data recalling.

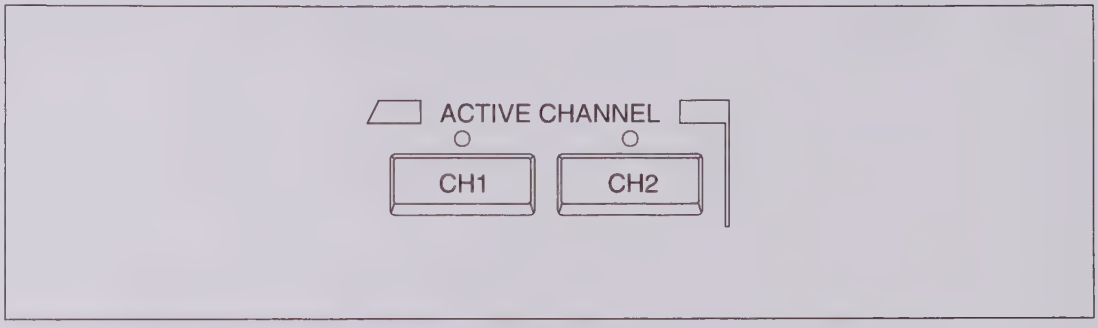
Refer to Figure 9-1 for the flow of three data.

7 FUNCTION DESCRIPTIONS

This chapter describes about the function of each section in details to promote better understanding.

Please make use of "A.4 Soft Key Menu List" at the end of this manual.

7.1 ACTIVE CHANNEL Block



ACTIVE CHANNEL block is used to select which channel will be used for the active channel.

The R3765/67G series has two measurement channels which can be independently used for measurement and data display.

The R3765/67G series can perform the simultaneous measurement for reflection and transfer characteristics of DUT or the simultaneous measurement under different frequency conditions.

(1) The active channel is the channel for which various conditions can be set such as measurement or data display.

That is, all the channel-dependent functions will apply to the active channel.
The channel with its LED lit up is the current active channel.

(2) Each channel has the sub-measure screen.

The display on the sub-measure screen is displayed by setting input port under the conditions of the sub-measure ON in each channel. (Refer to sub-section 7.4.1 for sub-measure screen selection.)

- For example, when the current channel 1 is active, repressing channel 1 makes the sub-measure screen (channel 3) of channel 1 to active. Pressing channel 1 once more returns to channel 1.
- Channel 3 and channel 4 are only sub-measurement screens which are not independent. Therefore channel 1 is necessary for channel 3 display, and also channel 2 is necessary for channel 4 display.
- The sub-measure screen of channel 1 is channel 3, and the sub-measure screen of channel 2 is channel 4.

- In order to make the sub-measure screen active, press the channel key again.

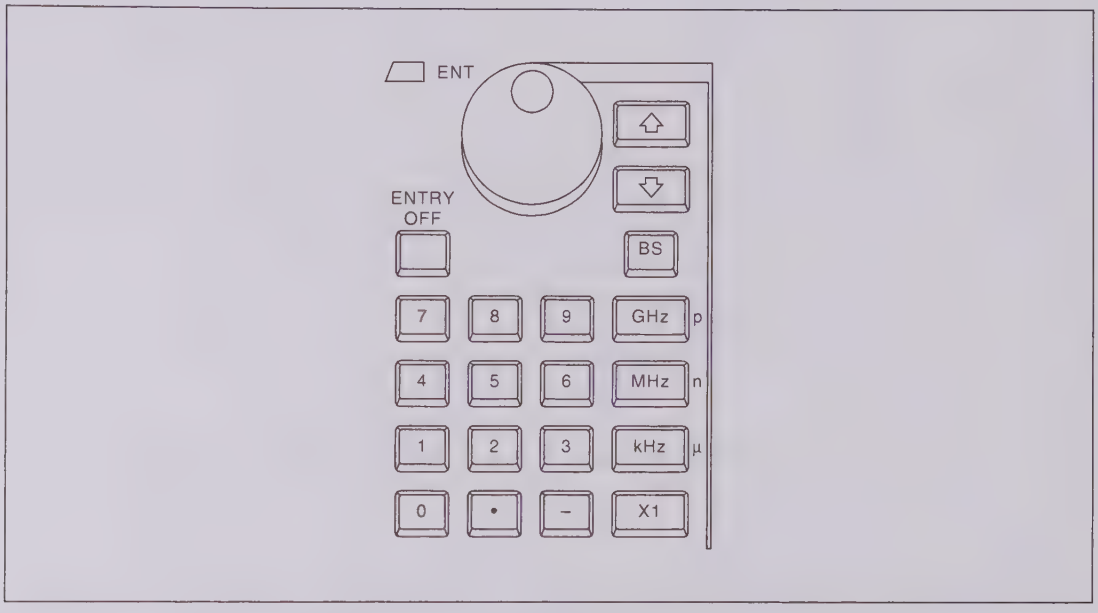
  [CH 1] : Sets channel 1 or channel 3 to active.
  [CH 2] : Sets channel 2 or channel 4 to active.

The setting of the signal source can be interlocked between the channels.

In the case, the conditions which has been set in the active channel will be also set in the other channel automatically. (Refer to sub-section 7.3.2.)

Note: ***The expression of 2 channels or channels designates channel 1 and channel 2. Also there are some cases that channel 3 and channel 4 are expressed as sub-measure screens.***

7.2 ENTRY Block



The ENTRY block is used to set data input/change for the selected function by using the **[Panel key]** and *{Soft key}*.

This block is also used to set/change a marker.

(1) Numeric keys : **[0]** to **[9]** ; Ten keys
[.] ; Decimal point key
[-] ; Minus sign key
[BS] ; Back space key
[ENTRY OFF] ; Entry off key
Clears all numeric data and also cancels an input request.

Note : After numeric key operation, press unit keys.

Input numeric values by using numeric keys, a decimal point key and a minus sign key. Then, press a unit key after inputting the numeric value.

Pressing the unit key determines the unit of the input numeric values and terminates numeric entry. Namely the numeric entry is not complete until is specified by pressing a unit key.

While an arrow (⇨) is being displayed on the left side of the active entry area, the numeric entry does not complete.

(2) Unit key

- The suffix for basic units of "Hz", "deg" and "Ω" is commonly supported by the following unit keys.

  [GHz] p : Giga (10^9)
  [MHz] n : Mega (10^6)
  [kHz] μ : Kiro (10^3)
  [X1] : X1 (10^0)

- The suffix for basic units of "sec" and "m" or for real values without unit is commonly supported by the following unit keys.

  [GHz] p : Pico (10^{-12})
  [MHz] n : Nano (10^{-9})
  [kHz] μ : Micro (10^{-6})
  [X1] : X1 (10^0)

If a basic unit other than the above is used, its suffix is not supported.

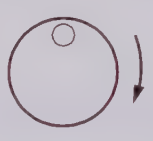
(3) ENTRY OFF key

Deletes the menu or turns the data entry on or off.
When the menu is displayed, pressing the ENTRY OFF key deletes the menu.
If the ENTRY OFF key is pressed again, the data entry is displayed.
Once the PRESET key is pressed or the data entry is canceled by the R3765/67G series itself, the ENTRY OFF key can not make the data entry displayed again.

(4) Step key : [↑] & [↓]

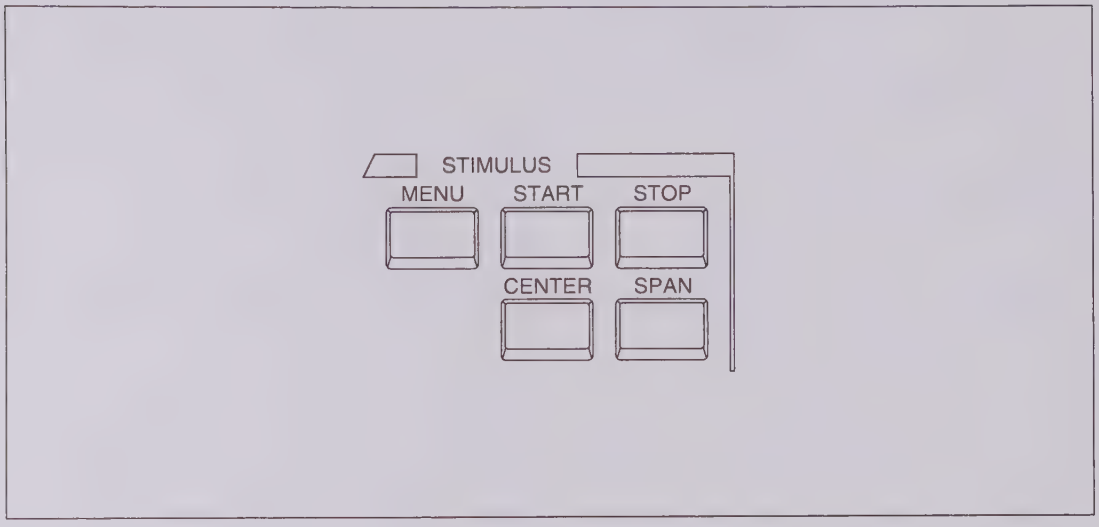
Increases or decreases the setting value with the specific step size. After the step key operation, no unit setting is required.

(5) Data knob :



Continuously makes the setting value variable.
After the data knob operation, no unit setting is required.

7.3 STIMULUS Block



This block is used to set the conditions concerning the signal sources such as a frequency range, power level setting, sweep type, sweep time and sweep resolution.

- Setup key

  [MENU] : Calls the signal source menu to be set such as an output level, sweep time, sweep type and sweep resolution. (Refer to sub-section 7.3.1.)

  [START] : Specifies the sweep start.
  Sets each start frequency or start power when the sweep type is a frequency type or power type.
  The start position on the time axis is set, when the time domain display is ON.

  [STOP] : Specifies sweep stop.
  Sets each stop frequency or power when the sweep type is a frequency type or power type.
  The stop position on the time axis is set, when the time domain display is ON.

  [CENTER] : Specifies the center sweep.
  Set center frequency when the sweep type is a frequency type.
  The center position on the time axis is set, when the time domain display is ON.

  [SPAN] : Specifies the sweep span.
  Set frequency span when the sweep type is a frequency type.
  When the time domain display is turned on, the time span on the time axis is set.

- Set the sweep range by pressing the **[START]**, **[STOP]**, **[CENTER]** or **[SPAN]**.
- For the other settings, press the **[MENU]** to call the signal source menu, then perform the setting.

7.3.1 Setting Signal Source

The Setting and the Explanation

① Press the **[MENU]** to call the signal source menu. (Refer to section A.4.)

② Signal source menu

{POWER} : Calls the power menu used for selecting an output power and an output port. (See step ③.)

{SWEEP TIME} : Sets the sweep time.
When a zero is set, AUTO is selected.
When AUTO is set, the minimum sweep time is set according to the sweep frequency range and receiver section resolution bandwidth.

{SWEEP TYPE [ ]} : Calls the sweep type menu for selecting a sweep type. (Refer to section 7.7.)

{TRIGGER [ ]} : Calls the trigger menu for selecting a sweep trigger condition. (See step ④.)

{POINTS} : Sets the number of sweep point. The number of settable points are: 3, 6, 11, 21, 51, 101, 201, 301, 401, 601, 601, 801 or 1201 points.

{COUPLED CH ON/OFF} : Selects whether the setting conditions concerning the channels 1 and 2 are same or not. (Refer to sub-section 7.3.2.)

{CW FREQ} : Sets the frequency at power sweep.

{RESTART} : Restarts the measurement from sweep start.
When this key is pressed, the sweep restarts from the start, even if the sweep is uncompleted.

③ Power menu

{ATT MODE AUTO/FIX} : Sets an attenuator mode.

AUTO Automatically sets the attenuator to output the level specified in *{POWER}*. In this mode, however, *{ATTENUATOR SOURCE}* and *{ATTENUATOR PORT n}* (n=1 to 4) cannot be set.

FIX Sets the attenuator manually. The output level of SOURCE or ATTENUATOR PORT n (n=1 to 4) is:
[Setting value in *{POWER}* - *{ATTENUATOR SOURCE}*],
or
[Setting value in *{POWER}* - *{ATTENUATOR PORT n}*].

*OPT 10 (Output attenuator)

{POWER} : Sets the output level during frequency sweep.

{ATTENUATOR SOURCE} : Sets an attenuator value for the signal source (used with only AG model).
*OPT 10 (Output attenuator)

{ATTENUATOR PORT 1} : Sets the PORT 1 attenuator value.
*OPT10 (Output attenuator)

{ATTENUATOR PORT 2} : Sets the PORT 2 attenuator value. (used with the CG model)
*OPT10 (Output attenuator)

{ATTENUATOR PORT3} Sets the PORT3 attenuator value. (used with only OPT11 or 13)
* OPT10 (output attenuator)

{ATTENUATOR PORT4} Sets the PORT4 attenuator value. (used with only OPT14)
* OPT10 (output attenuator)

④ Trigger menu

{CONTINUOUS} : Continuously performs sweep.

{SINGLE} : Performs sweep once.
If this key is pressed in the middle of a sweep, the measurement of the sweep is interrupted and a sweep is restarted.

{HOLD} : Stops sweep measurement.
If this key is pressed in the middle of sweep, immediately sweep is interrupted.

{INT TRIG} : Automatically starts sweep by an internal source.

{EXT TRIG} : Starts sweep by an external synchronization signal.
The external synchronization signal is input through the parallel I/O connector 18-pin of the rear panel.
(Negative logic, pulse width ; 1μs or more.)

{TRIGGER DELAY} : Sets delay time between receiving the trigger signal and the start of sweep.

7.3.2 Interlocking between Channels

Selects whether the measurement condition concerning the signal source is set at the same condition or independently set in each channel when two-channel simultaneous measurement.

(1) For interlock setting :

The conditions which has been set to the active channel will be automatically set to the other channel as same.

(2) For independent setting :

Different measuring condition can be set to channel 1 and 2, respectively.

The setting conditions which can be interlocked between channels are show below:

- Sweep type
- Frequency
- Output level
- Sweep time
- Number of measurement point
- Resolution bandwidth

The Setting and the Explanation

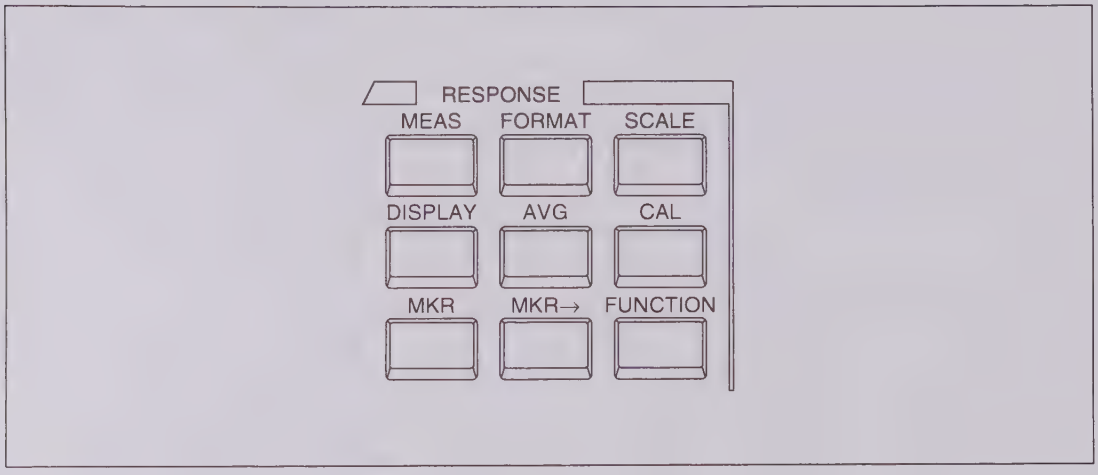
① Press the **[MENU]** to call the signal source menu. (Refer to section A.4.)

② Press the *{COUPLED CH ON/OFF}* to select whether the setting conditions concerning two measurements are set to the same or not.

ON : Measures channel 1 and channel 2 simultaneously.
OFF : Measures channel 1 and channel 2 alternately. (Performs the measurement of channel 1 and them channel 2.)

- When the sub-measure screen (channel 3 or channel 4) of channel 1 or channel 2 is selected, channel 3 always operates with channel 1 and channel 4 operates with channel 2.
  On the display of the sub-measure screen, the input port can be set in the state of sub-measure ON.
  However, INPUT PORTs can be set independently.

7.4 RESPONSE Block



The RESPONSE block is used to set the measurement conditions of receiver section, measurement parameters, measurement format, display format and marker for an active channel.

[MEAS] : Calls the measurement menu for selecting an input port and measurement parameters. (Refer to sub-section 7.4.1.)

[FORMAT] : Calls the format menu for selecting the format of measurement data. (Refer to sub-section 7.4.2.)

[SCALE] : Calls the scale menu for setting the display coordinate axis. (Refer to sub-section 7.4.3.)

[DISPLAY] : Calls the display menu for executing 2-channel simultaneous display, trace operation function, and label input. (Refer to sub-section 7.4.4.)

[AVG] : Calls the average menu for executing data average, smoothing, resolution bandwidth setting. (Refer to sub-section 7.4.10.)

[CAL] : Calls the calibration menu for setting calibration function. (Refer to section 7.5.)

[MKR] : Calls the marker menu for setting a marker. (Refer to section 7.6.)

[MKR →] : Calls the marker search menu for setting analysis by using a marker. (Refer to sub-section 7.6.7.)

[FUNCTION] : Calls the time domain (OPT70), CDMA IF filter or automatic calibration function (refer to Sections 7.7 and 7.8).

7.4.1 Setting Input and Parameter Conversion

Selects the receiver section input port.

With the sub-measure screen, the input port can be set in the condition of sub-measure ON.

The data which is measured in the selected input port is a "complex data". This data is also formatted such as the magnitude, phase, group delay. Data before formatting can be changed to impedance, admittance, reverse S parameter.

The Setting and the Explanation

① Press the **[MEAS]** to call the measurement menu. (Refer to section A.4.)

② Measurement menu

- For R3765CG/67CG

  {S11 REFL FWD} : Sets the input port to S_{11} REFL FWD.

  {S21 TRANS FWD} : Sets the input port to S_{21} TRANS FWD.

  {S12 TRANS REV} : Sets the input port to S_{12} TRANS REV.

  {S22 REFL REV} : Sets the input port to S_{22} REFL REV.

  {S11&S21 FWD} : Sets the input port to S_{11}&S_{21} FWD.

  {S22&S12 REV} : Sets the input port to S_{22}&S_{12} REV.

  {SUB MEAS ON/OFF}: Sets the ON/OFF of sub measurement.

  {CONVERSION [ ]} : Calls the parameter menu for converting the measured data to an impedance, admittances or reverse S parameters. (See step ③.)

- For R3765AG/67AG

  {A/R} : Sets the input port to A/R.

  {B/R} : Sets the input port to B/R.

  {SUB MEAS ON/OFF} : Sets the sub-measure ON or OFF.

  {CONVERSION [ ]} : Calls the parameter converting menu to covert the measured data to impedance or admittance. (See step ③.)

- For R3765BG/67BG

  {REFLECTION} : Sets the input port to REFLECTION.

  {TRANSMISSION} : Sets the input port to TRANSMISSION.

  {REFL & TRANS} : Sets the input port to REFL & TRANS.

  {SUB MEAS ON/OFF} : Sets the sub-measure ON or OFF.

  {CONVERSION [ ]} : Calls the parameter converting menu to convert the measured data to impedance or admittance. (See step ③.)

- When the R3765CG or R3767CG is used with OPT11/OPT14:

  {S11(PORT1)} : Sets the measurement parameter to S11.

{S22(PORT2)} : Sets the measurement parameter to S22.

{S33(PORT3)} : Sets the measurement parameter to S33.

{S44(PORT4)} : Sets the measurement parameter to S44.

{S21(P2 ← P1)} : Sets the measurement parameter to S21.

{S12(P2 → P1)} : Sets the measurement parameter to S12.

{S31(P1 → P3)} : Sets the measurement parameter to S31.

{S13(P1 ← P3)} : Sets the measurement parameter to S13.

{S32(P2 → P3)} : Sets the measurement parameter to S32.

{S23(P2 ← P3)} : Sets the measurement parameter to S23.

{S41(P1 → P4)} : Sets the measurement parameter to S41 (For OPT14).

{S14(P1 ← P4)} : Sets the measurement parameter to S14 (For OPT14).

{S42(P2 → P4)} : Sets the measurement parameter to S42 (For OPT14).

{S24(P2 ← P4)} : Sets the measurement parameter to S24 (For OPT14).

{S43(P3 → P4)} : Sets the measurement parameter to S43 (For OPT14).

{S34(P3 ← P4)} : Sets the measurement parameter to S34 (For OPT14).

{TEST - PORT CONNECTION (P1 - P2)}:
Indicates that the current measurement is performed between TEST PORT1 and TEST PORT2. When this menu is selected, the measurement ports are switched to TEST PORT1 and TEST PORT2.

{TEST - PORT CONNECTION (P1 - P3)}:
Indicates that the current measurement is performed between TEST PORT1 and TEST PORT3. When this menu is selected, the measurement ports are switched to TEST PORT1 and TEST PORT3.

{TEST - PORT CONNECTION (P2 - P3)}:
Indicates that the current measurement is performed between TEST PORT2 and TEST PORT3. When this menu is selected, the measurement ports are switched to TEST PORT2 and TEST PORT3.

{TEST - PORT CONNECTION (P1 - P4)}:
Indicates that the current measurement is performed between TEST PORT1 and TEST PORT4. When this menu is selected, the measurement ports are switched to TEST PORT1 and TEST PORT4 (For OPT14).

{TEST - PORT CONNECTION (P2 - P4)}:
Indicates that the current measurement is performed between TEST PORT2 and TEST PORT4. When this menu is selected, the measurement ports are switched to TEST PORT2 and TEST PORT4 (For OPT14).

{TEST - PORT CONNECTION (P3 - P4)}:
Indicates that the current measurement is performed between TEST PORT3 and TEST PORT4. When this menu is selected, the measurement ports are switched to TEST PORT3 and TEST PORT4 (For OPT14).

{TWIN MEAS} : Opens the menu to select the twin parameter, which performs two measurements simultaneously.

{S11 & S21 (P2 ← P1)}:
Sets the twin measurement parameter to S11 and S21.

{S22 & S12 (P2 → P1)}:
Sets the twin measurement parameter to S22 and S12.

{S11 & S31 (P1 → P3)}:
Sets the twin measurement parameter to S11 and S31.

{S33 & S13 (P1 ← P3)}:
Sets the twin measurement parameter to S33 and S13.

{S22 & S32 (P2 → P3)}:
Sets the twin measurement parameter to S22 and S32.

{S33 & S23 (P2 ← P3)}:
Sets the twin measurement parameter to S33 and S23.

{S11 & S41 (P1 → P4)}:
Sets the twin measurement parameter to S11 and S41 (For OPT14).

{S44 & S14 (P1 ← P4)}:
Sets the twin measurement parameter to S44 and S14 (For OPT14).

{S22 & S42 (P2 →P4)}:
Sets the twin measurement parameter to S22 and S42 (For OPT14).

{S44 & S24 (P2 ← P4)}:
Sets the twin measurement parameter to S44 and S24 (For OPT14).

{S33 & S43 (P3 → P4)}:
Sets the twin measurement parameter to S33 and S43 (For OPT14).

{S44 & S34 (P3 ← P4)}:
Sets the twin measurement parameter to S44 and S34. (For OPT14)

③ Parameter conversion menu

{Z(REFL)} : Executes the impedance conversion by the reflection measurement.

Conversion expression = $\frac{1+\rho}{1-\rho} \times Z_0$

{Z(TRANS)} : Executes the impedance conversion by the transmission measurement.

Conversion expression = $\frac{2(1-T)}{T} \times Z_0$

{Y(REFL)} : Executes the admittance conversion by the reflection measurement.

Conversion expression = $\frac{1-\rho}{1+\rho} \times \frac{1}{Z_0}$

{Y(TRANS)} : Executes the admittance conversion by the transmission measurement.

Conversion expression = $\frac{T}{2(1-T)} \times \frac{1}{Z_0}$

{1/S} : Converts the S parameter to the reverse S parameter.

Conversion expression = $\frac{1}{S}$

{OFF} : Turns off the conversion function.

{Z0 VALUE} : Sets the characteristics impedance (Z_0).

Note: ρ : ***Reflection coefficient***
T : ***Gain***
S : ***Reflection coefficient or gain***
Z_0 : ***Characteristics impedance***

7.4.2 Display Data Format

Formats the measurement data. Data is displayed as the type formatted.

The Setting and the Explanation

① Press the **[FORMAT]** to call the format menu. (Refer to section A.4.)

② Format menu

- Format menu (1 of 2)

{LOG MAG}	:	Sets to the logarithmic magnitude display.
{PHASE}	:	Sets to the phase display. The display is changed to the loop back display in ±180°.
{DELAY}	:	Sets to the group delay display.
{SMITH (R+jX)}	:	Sets to the Smith chart.
{SMITH (G+jB)}	:	Sets to the admittance chart.
{POLAR}	:	Sets to the polar coordinates display.
{LIN MAG}	:	Sets to the linear magnitude.

- Format menu (2 of 2)

{SWR}	:	Sets to the SWR (standing wave ratio) display.
{REAL}	:	Sets to the measurement data real display.
{IMAG}	:	Sets to the measurement data imaginary display.
{PHASE -∞, +∞}	:	Sets to the continuous phase display. The phase is changed to the no loopback display in ±180° based on the one point data.
{LOG MAG & PHASE}	:	Sets to the simultaneous display with logarithmic magnitude and phase.
{LOG MAG & DELAY}	:	Sets to the simultaneous display with logarithmic magnitude and group delay.
{LIN MAG & PHASE}	:	Sets to the simultaneous display with linear magnitude and phase.

7.4.3 Setting Display Coordinate Scale

The coordinate in accordance with selected format is displayed on the screen.

The coordinate scale is changed on the scale menu.

The Setting and the Explanation

① Press the **[SCALE]** to call the scale menu. (Refer to section A.4.)

② Scale menu

{AUTO SCALE} : Automatically sets the display coordinate to be an optimize value for display trace.

{/DIV} : For the rectangular coordinate display, sets the value of the vertical axis 1 scale.
*This function cannot be set for the Smith chart or the polar coordinates.

{REF VALUE} : Sets the reference position value of the display coordinate.
*This function cannot be set for the Smith chart or the polar coordinates.

{REF POS} : Specifies the reference position of the display coordinate.
*This function cannot be set for the Smith chart or the polar coordinates.

{MARKER→REF.VALUE} : The value at the active marker becomes the reference value.
*This function cannot be set for the Smith chart or the polar coordinates.

{REF LINE ON/OFF} : Selects ON/OFF of the reference position display.
*This function cannot be set for the Smith chart or the polar coordinates.

{TRACE 2nd/1st} : Selects a preferred trace in displaying two traces simultaneously.
*This function cannot be set for the Smith chart or the polar coordinates.

{FULL SCALE} : Sets the size of the circle displayed for the Smith chart and polar display.

7.4.4 Four Screen Display and Display Selection Information

The 2 channels simultaneous display can be performed.

Each channel has a sub-measure screen display, so that four-screen-display in total can be performed.

Also the selection of the trace data, the coordinate display ON/OFF and the label input can be performed.

The Setting and the Explanation

① Press the **[DISPLAY]** to call the display menu. (Refer to section A.4.)

② Display menu

- Display menu (1 of 2)

  {DUAL CH ON/OFF} : Selects ON/OFF of the two channels simultaneous display (overlap display). (Note)

  {SPLIT CH ON/OFF} : Selects ON/OFF of the display split in two, the upper part and the lower part (split display). (Note)

  {DISPLAY [ ]} : Calls the trace data selection menu to select whether measurement data, memory data and both data is displayed. (Refer to sub-section 7.4.6.)

  {DEFINE TRACE [ ]} : Calls the trace operation menu.
  Four fundamental operations are executed for the measured data and the memory data. (Refer to sub-section 7.4.7.)

  {DATA → MEMORY} : Enters data into memory.
  When two-trace display has been selected, data toggled by *{TRACE 2nd/1st}* is entered.

  {CONVERSION [ ]} : Calls the parameter selection menu to convert the measured data into an impedance or an admittance. (Refer to ③ of sub-section 7.4.1.)

  {TRACE 2nd/1st} : Selects between the 1st trace and the 2nd trace.

  Note: Depending on which SUB MEAS is chosen, the ON/OFF settings of SPLIT CH and DUAL CH or the status of the marker list, the screen display varies.

- Display menu (2 of 2)

  {GRATICULE ON/OFF} : Selects ON/OFF of the coordinate display.
  * This function cannot be set for the Smith chart or the polar coordinates.

  {LABEL} : Calls the label menu for entering the label. (Refer to sub-section 7.4.8.)

  {COLOR} : Specifies the color of the trace and the marker. (Refer to sub-section 7.4.9.)

  {DEFAULT COLOR} : Sets all color setting to default.

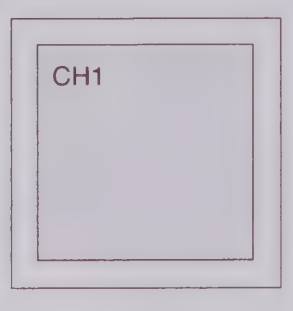
{MENU OVERLAY ON/OFF}:
Extends the measurement screen to the menu area.
When this function is turned on, part of the trace display area is hidden behind the menu display.
The menu display will turn off by pressing the ENTRY OFF key.

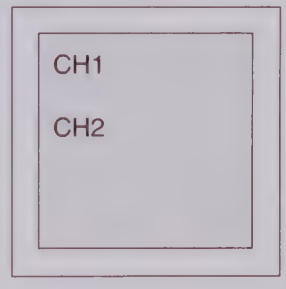
{SCALE UP ON/OFF} : Widens the measurement screen. .
When this function is turned on, the real time clock and label are hidden.

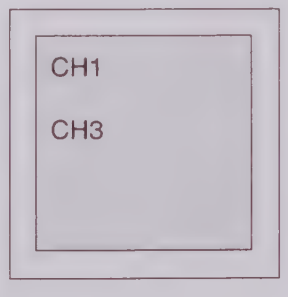
{ANNOTATION ON/OFF}: Turns the annotation display on or off on the measurement screen.
When this function is turned off, the trace display area is extended to the upper and lower annotation display areas.

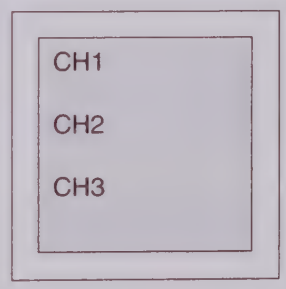
7.4.5 Display Layout

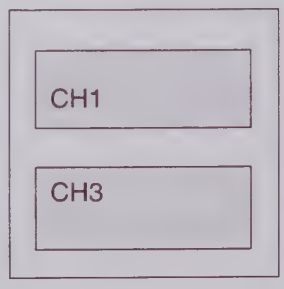
(1) Examples showing that the marker list is OFF and in the superposition mode

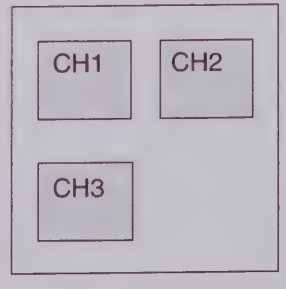
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: OFF SPLIT CH: OFF CH1 SUB MEAS: OFF CH2 SUB MEAS: OFF	

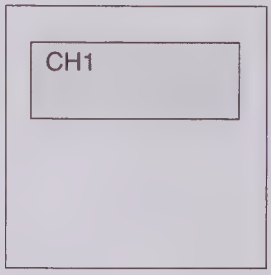
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: ON SPLIT CH: OFF CH1 SUB MEAS: OFF CH2 SUB MEAS: OFF	

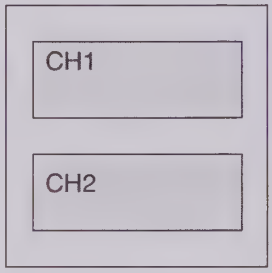
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: OFF SPLIT CH: OFF CH1 SUB MEAS: ON CH2 SUB MEAS: OFF	

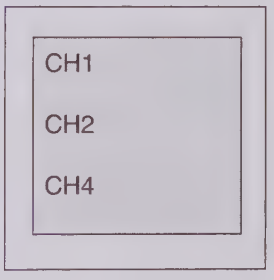
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: ON SPLIT CH: OFF CH1 SUB MEAS: ON CH2 SUB MEAS: OFF	

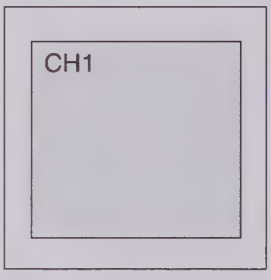
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: OFF SPLIT CH: ON CH1 SUB MEAS: ON CH2 SUB MEAS: OFF	

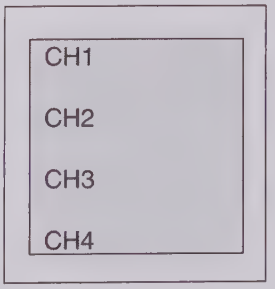
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: ON SPLIT CH: ON CH1 SUB MEAS: ON CH2 SUB MEAS: OFF	

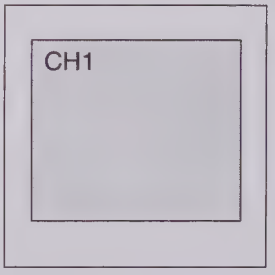
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: OFF SPLIT CH: ON CH1 SUB MEAS: OFF CH2 SUB MEAS: OFF	

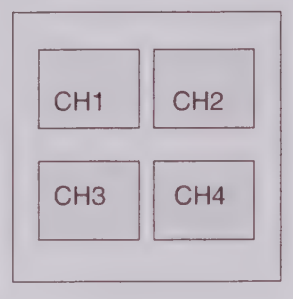
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: ON SPLIT CH: ON CH1 SUB MEAS: OFF CH2 SUB MEAS: OFF	

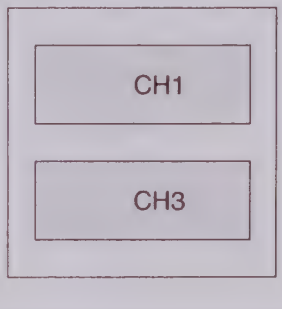
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: ON SPLIT CH: OFF CH1 SUB MEAS: OFF CH2 SUB MEAS: ON	

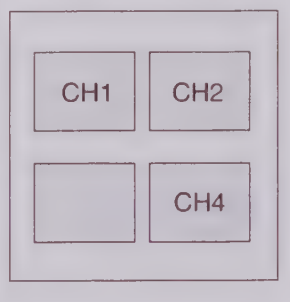
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: OFF SPLIT CH: OFF CH1 SUB MEAS: OFF CH2 SUB MEAS: ON	

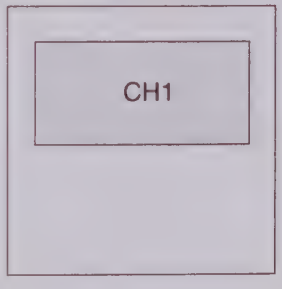
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: ON SPLIT CH: OFF CH1 SUB MEAS: ON CH2 SUB MEAS: ON	

Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: OFF SPLIT CH: OFF CH1 SUB MEAS: OFF CH2 SUB MEAS: ON	

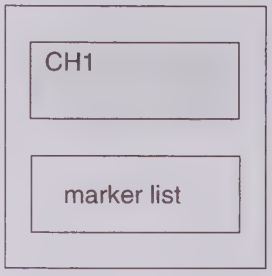
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: ON SPLIT CH: ON CH1 SUB MEAS: ON CH2 SUB MEAS: ON	

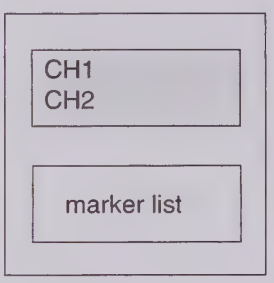
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: OFF SPLIT CH: ON CH1 SUB MEAS: ON CH2 SUB MEAS: ON	

Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: ON SPLIT CH: ON CH1 SUB MEAS: OFF CH2 SUB MEAS: ON	

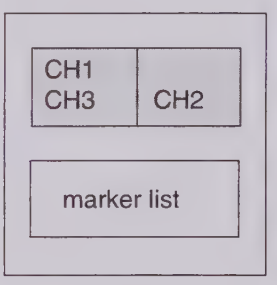
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: OFF SPLIT CH: ON CH1 SUB MEAS: OFF CH2 SUB MEAS: ON	

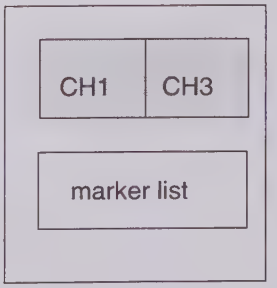
(2) Examples showing that the marker list is ON and in the split mode

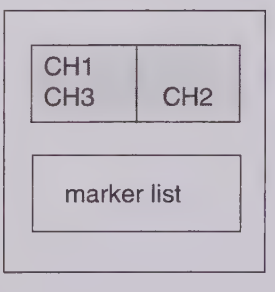
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: OFF SPLIT CH: OFF CH1 SUB MEAS: OFF CH2 SUB MEAS: OFF	

Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: ON SPLIT CH: OFF CH1 SUB MEAS: OFF CH2 SUB MEAS: OFF	

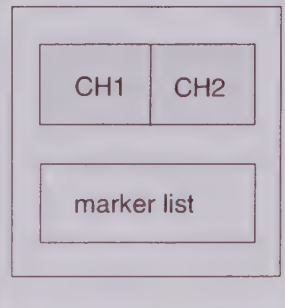
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: OFF SPLIT CH: OFF CH1 SUB MEAS: ON CH2 SUB MEAS: OFF	

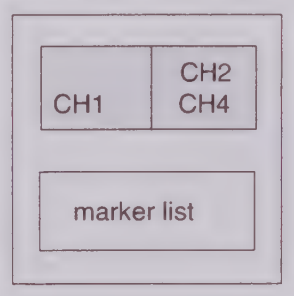
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: ON SPLIT CH: OFF CH1 SUB MEAS: ON CH2 SUB MEAS: OFF	

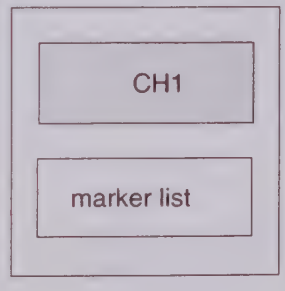
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: OFF SPLIT CH: ON CH1 SUB MEAS: ON CH2 SUB MEAS: OFF	

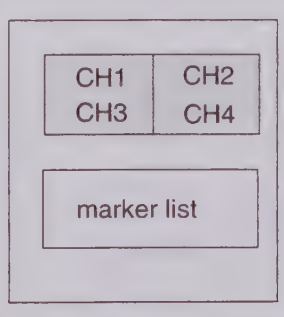
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: ON SPLIT CH: ON CH1 SUB MEAS: ON CH2 SUB MEAS: OFF	

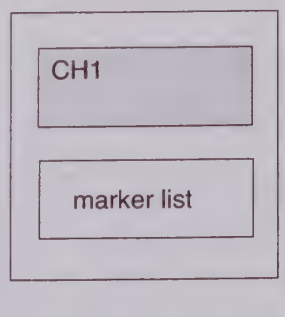
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: OFF SPLIT CH: ON CH1 SUB MEAS: OFF CH2 SUB MEAS: OFF	

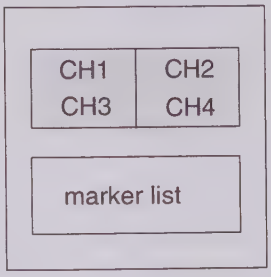
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: ON SPLIT CH: ON CH1 SUB MEAS: OFF CH2 SUB MEAS: OFF	

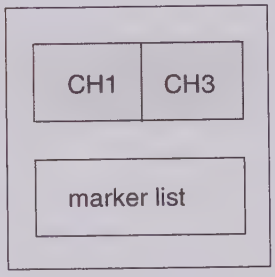
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: ON SPLIT CH: OFF CH1 SUB MEAS: OFF CH2 SUB MEAS: ON	

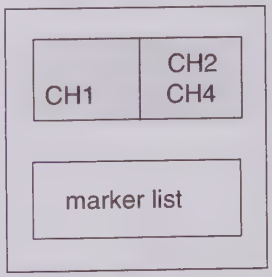
Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: OFF SPLIT CH: OFF CH1 SUB MEAS: OFF CH2 SUB MEAS: ON	

Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: ON SPLIT CH: OFF CH1 SUB MEAS: ON CH2 SUB MEAS: ON	

Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: OFF SPLIT CH: OFF CH1 SUB MEAS: OFF CH2 SUB MEAS: ON	

Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: ON SPLIT CH: ON CH1 SUB MEAS: ON CH2 SUB MEAS: ON	

Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: OFF SPLIT CH: ON CH1 SUB MEAS: ON CH2 SUB MEAS: ON	

Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: ON SPLIT CH: ON CH1 SUB MEAS: OFF CH2 SUB MEAS: ON	

Setting conditions	Layout configuration
ACTIVE CH: CH1 DUAL CH: OFF SPLIT CH: ON CH1 SUB MEAS: OFF CH2 SUB MEAS: ON	

7.4.6 Trace Data Selection

The trace data selection menu allows you to select the measured data, the memory data or both data.

The Setting and Explanation

① Press the **[DISPLAY]** to call the display menu. (Refer to section A.4.)

② Press the *{DISPLAY[ ]}* to call the trace data selection menu.

③ Trace data selection menu

{DISPLAY DATA} : Displays the measured data only.

{DISPLAY MEMORY} : Displays the memory data only.

{DISPLAY DATA & MEM} : Displays both the measured data and the memory data.

7.4.7 TRACE Operation

The trace operation is used to execute fundamental arithmetic operation between the measurement data and memory data.

The Setting and the Explanation

① Press the **[DISPLAY]** to call the display menu. (Refer to section A.4.)

② Press the *{DEFINE TRACE[ ]}* to call the trace operation.

③ Trace operation menu

{DATA/MEM}	:	Executes the division of measurement data and memory data, then displays the result as the measurement data.
{DATA-MEM}	:	Executes the subtraction of measurement data and memory data, then displays the result as the measurement data.
*{DATA*MEM}*	:	Executes the of multiplication of measurement data and memory data, then displays the result as the measurement data.
{DATA+MEM}	:	Executes the addition of measurement data and memory data, then displays the result as the measurement data.
{OFF}	:	Cancels the operation (calculation).

7.4.8 Label Input

An annotation of measurement data and so on is input as a label. Maximum 64 characters can be input.

The Setting and the Explanation

① Press the **[DISPLAY]** to call the display menu. (Refer to section A.4.)

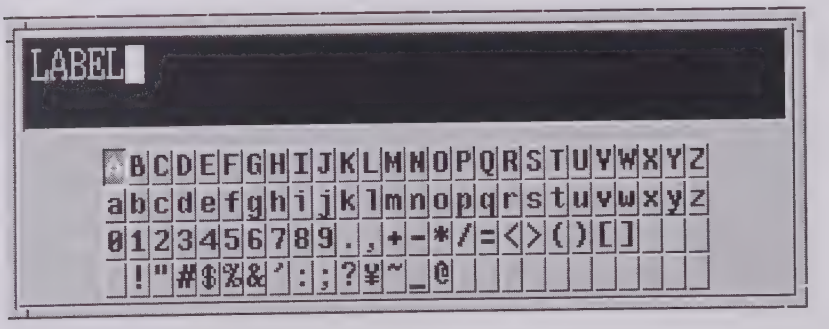
② Press the *{More 1/2}*.

③ Press the *{LABEL}* to call the label window and label menu.

④ Label menu
(Select the character of label menu by using the data knob, and press the **[X1]**.)

{DONE}	:	Completes the label input.
{CURSOR →}	:	Shifts the cursor indicating the label input position to the right.
{CURSOR ←}	:	Shifts the cursor indicating the label input position to the left.
{BACK SPACE}	:	Backspaces.
{DELETE CHAR}	:	Deletes one character.
{CLEAR LINE}	:	Deletes all characters.
{CANCEL}	:	Cancels the edit.

Label Window Display



7.4.9 Colors Settings

The following explains how to set the colors of traces and markers for each channel.

Operation procedure

① Press the **[DISPLAY]** to call the display menu.
Press the *{More 1/2}*.
Press the *{COLOR}* to call the color menu.
{DEFAULT COLOR} : Changes all color settings to their default values.

② Color menu

- Color menu (1 of 3)

{1ST TRACE} : Sets the color of the first trace for the active channel.
When this function is selected, the RGB menu is displayed.

{2ND TRACE} : Sets the color of the second trace for the active channel.
When this function is selected, the RGB menu is displayed.

{1ST MARKER} : Sets the color of the normal marker on the first trace for the active channel.
When this function is selected, the RGB menu is displayed.

{2ND MARKER} : Sets the color of the normal marker on the second trace for the active channel.
When this function is selected, the RGB menu is displayed.

{REF LINE} : Sets the color of the reference line for the active channel.
When this function is selected, the RGB menu is displayed.

{ACTIVE MARKER}: Sets the color of the active marker for the active channel.
When this function is selected, the RGB menu is displayed.

- Color menu (2 of 3)

{SCREEN} : Sets the screen color.
When this function is selected, the RGB menu is displayed.

{GRID FG} : Sets the color of the grid of coordinates display.
When this function is selected, the RGB menu is displayed.

{GRID BG} : Sets the background color of the trace display area.
When this function is selected, the RGB menu is displayed.

{WINDOW BG} : Sets the box color of the trace display window.
When this function is selected, the RGB menu is displayed.

{SWEEP MARKER}: Displays the color of the sweep indicator.
When this function is selected, the RGB menu is displayed.

- Color menu (3 of 3)

{ANNOTATION} : Sets the color of the channel name being displayed on the box of the trace display window and the color of the annotation such as stimulus data.
When this function is selected, the RGB menu is displayed.

{CLOCK} : Sets the color of the date and clock display at the top right-hand corner of the screen.
When this function is selected, the RGB menu is displayed.

{LABEL} : Sets the color of the label display.
When this function is selected, the RGB menu is displayed.

{OVERLAY TEXT} : Sets the color of the overlay text displayed in the active area.
When this function is selected, the RGB menu is displayed.

{BASIC TEXT} : Sets the color of the BASIC TEXT.
When this function is selected, the RGB menu is displayed.

③ RGB menu

Determines the color of each item by the proportions of R(Red), G(Green) and B(Blue). Each value of RGB can be set in the range 0 to 255.
A setting of 0 for each value is displayed as black while a setting of 255 for each value is displayed as white.

{RED} : Performs the setting of RED.

{GREEN} : Performs the setting of GREEN.

{BLUE} : Performs the setting of BLUE.

The changed value is stored in the environmental file of the system.
It is valid in turning on the power next time.

7.4.10 Averaging/Smoothing and Resolution Bandwidth

Averaging [time average] and smoothing [moving average] are provided as the function which statistically reduces random errors that cannot be reproduced. (Refer to (1) and (2).)

Narrow resolution bandwidth will reduce noise component, thus decreasing random errors. However, the case will increase the sweeping time.

The Setting and the Explanation

① Press the **[AVG]** to call the average menu. (Refer to section A.4.)

② Average menu

{AVG STATE ON/OFF} : Selects ON/OFF of averaging.

{AVG COUNT} : Sets the number of times for averaging.

{AVG RESTART} : Resets the averaging and restarts at the average time 1.

{GROUP DELAY APERTURE}: Sets the aperture for group delay measurement. The aperture should be considered in the same manner as the smoothing aperture.

{SMOOTHING ON/OFF} : Selects ON/OFF of smoothing.

{SMOOTHING APERTURE} : Sets the smoothing aperture.

{TRACE 2ND/1ST} : Selects between the 1st trace and the 2nd trace.

{IF RBW [ ]} : Sets the resolution bandwidth. When "0" is entered, the resolution bandwidth is automatically set [AUTO] depending on the measurement frequency.

Resolution bandwidth	Maximum sweeping per point
20kHz	0.100msec/POINT
15kHz	0.125msec/POINT
10kHz	0.150msec/POINT
7kHz	0.200msec/POINT
5kHz	0.250msec/POINT
4kHz	0.300msec/POINT
3kHz	0.400msec/POINT
2kHz	0.550msec/POINT
1.5kHz	0.750msec/POINT
1kHz	1.0msec/POINT
700Hz	1.4msec/POINT
500Hz	1.9msec/POINT
400Hz	2.7msec/POINT

Resolution bandwidth	Maximum sweeping per point
300Hz	3.4msec/POINT
200Hz	5.0msec/POINT
150Hz	7.0msec/POINT
100Hz	11.0msec/POINT
70Hz	14.0msec/POINT
50Hz	19.0msec/POINT
40Hz	26.1msec/POINT
30Hz	34.9msec/POINT
20Hz	50.1msec/POINT
15Hz	70.1msec/POINT
10Hz	99.3msec/POINT

Depending on the measurement frequency, the IF RBW AUTO function automatically switches the resolution bandwidth during sweeping since the resolution bandwidth cannot be distinguished within the sweep frequency range.
When [AUTO] is set, the resolution bandwidth is automatically selected according to the measurement frequency range as shown in the table below. Then the measurement is performed.

Measurement frequency	Resolution bandwidth
300kHz to 450kHz	10kHz
450kHz to 700kHz	15kHz
700kHz to 8GHz	20kHz

The following describes about averaging and smoothing.

(1) Averaging

In the averaging function, the measured data are averaged with time weight before formatting it. Since vector quantity is averaged, there also is an effect that reduces the noise level.

- Averaging process

$$\overline{Y}(n)= \frac{n-1}{n} \times \overline{Y}(n-1) + \frac{1}{n} \times Y(n) \quad (n \leq N)$$

$$\overline{Y}(n)= \frac{N-1}{N} \times \overline{Y}(n-1) + \frac{1}{N} \times Y(n) \quad (n > N)$$

$\overline{Y}(n)$: nth averaged data
$Y(n)$: nth data not averaged yet
N : Number of times for averaging

(2) Smoothing

The smoothing obtains the moving average between adjacent pieces of formatted data. Since scaler quantity is averaged, the noise width is reduced but the noise level will not be reduced.

- Smoothing process

$$\overline{D}(n) = \frac{D(n-m) + \cdots + D(n) + \cdots + D(n+m)}{2m+1}$$

$\overline{D}(n)$: nth format data already smoothed
$D(n)$: nth format data not smoothed yet
$2m$: Smoothing aperture

The aperture for the setting value is obtained using the following equation:

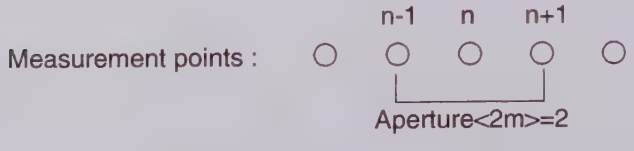
$$\text{Aperture}\langle 2m\rangle = \frac{(\text{measurement points}) - 1}{100} \times \langle \text{value} \rangle$$

That equation means that the aperture is set by the percentage for the number of the measurement points. Even if the number of the measurement points has been changed, the setting value of the aperture will be maintained and the aperture <2m> will be calculated again by the number of the measurement points after the change.

(Example)

Number of measurement points : 101(Point)

Aperture : 2(%) → Aperture $\langle 2m\rangle = \frac{101-1}{100} \times 2 = 2$



7.5 Calibration

There are eight types of calibration methods to reduce the system errors, as follows:

- Normalizing..... ① (Refer to sub-section 7.5.1 and (1), (2) of sub-section 7.5.5.)
- Normalizing & Isolation calibration ..... ② (Refer to sub-section 7.5.2 and (3) of sub-section 7.5.5.)
- 1-port full calibration ..... ③ (Refer to sub-section 7.5.2 and (4) of sub-section 7.5.5.)
- 2-port full calibration ..... ④ (Refer to sub-section 7.5.4 and (5) of sub-section 7.5.5.)
- 3-port full calibration ..... ⑤ (Available only when OPT 11/14 is installed. Refer to Section 7.5.11.)
- 4-port full calibration ..... ⑥ (Available only when OPT 14 is installed. Refer to Section 7.5.11.)
- Averaging..... ⑦ (Refer to sub-section 7.4.10.)
- Smoothing..... ⑧ (Refer to sub-section 7.4.10.)

The methods of ①,②,③,④.⑤ and ⑥are used to remove error factors which can be reproduced. These methods measure the standard whose real value has been known. The result is used to obtain the real value of the measurement according to the error model.

The methods of ⑦ and ⑧ are used to statistically reduce random errors by obtaining the time average and moving average respectively.

In addition, when using the R17050 automatic calibration kit is,③,④,⑤ and ⑥ can be calibrated by a simple operation. For more information, refer to the R17050 Automatic Calibration Kit operation manual.

Note: ***The calibration methods of ①,②,③,④,⑤ and ⑥ can not be performed simultaneously. Since the methods of ⑦ and ⑧ can be independently operated, they can be performed simultaneously.***

7.5.1 Normalizing

Calibrates the frequency characteristics of the magnitude and phase. This method can be easily performed but cannot obtain a high accuracy.

(1) For measuring transmission

Calibrates the frequency characteristics including that of the connection cable and connector by connecting the through standard with the condition where any sample is removed.

(2) For measuring reflection

An open standard or a short standard can be selected for the calibration standard. The frequency characteristics is calibrated in the reflection measurement by connecting the calibration standard.
Both the open standard and short standard are full reflection and the phase for the short standard is shifted by 180 °.
For the open standard, make sure that the reflection measurement port is actually made open.
For example, the calibration can be made when the measurement port is open (unloading condition) without the open standard for a calibrated N type connector.
However, if the open capacity is uncertain or if the open condition cannot be obtained because the measurement port is the line on the base board, the short standard should be used or the calibration should be made with the line made short.

7.5.2 Normalize & Isolation Calibration

In the measurement of the transmission characteristic, calibrate the frequency characteristics and the isolation.

The crosstalk from the signal source of the R3765/67G series to the receiver section and the change for the worse of isolation caused by the jig connected between the test ports can be calibrated easily to enlarge the dynamic range.

- The frequency characteristic containing the cable and the connecter is calibrated by connecting the through standards.
- The crosstalk characteristic is calibrated by connecting the load standard to the test port for the isolation characteristic.
  Also the isolation of the jig for measurement can be calibrated as well.

7.5.3 1-Port Full Calibration

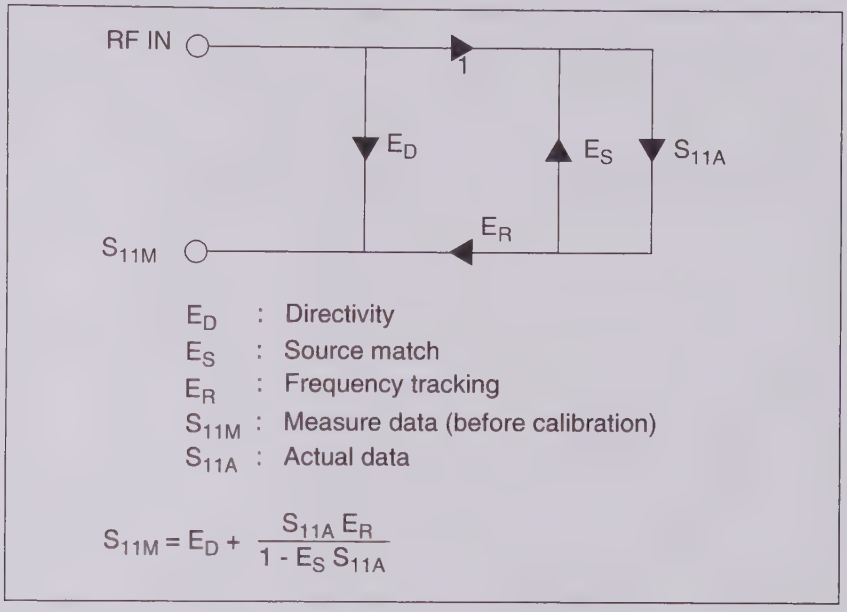
Calibrates the directivity, source match, and frequency tracking in the reflection measurement.

This method highly accurately measures the reflection of a one port device or a two port device whose one end is terminated.

(1) Three kinds of calibration standards are required as follows:

- Open standard
- Short standard
- Load standard

(2) The signal flow graph below shows the error model.



E_D : Directivity
E_S : Source match
E_R : Frequency tracking
S_{11M} : Measure data (before calibration)
S_{11A} : Actual data

$$S_{11M} = E_D + \frac{S_{11A} E_R}{1 - E_S S_{11A}}$$

Directivity : The directivity connector/bridge which is used for the reflection measurement detects the reflection signal from the sample device. However, it actually detects not only the reflection signal but also few incidence signals.
The limitation where the reflection signal and the incidence signal can be separated is called a "directivity".

Source match : The reflection signal from the sample device reflects at the signal source and is injected in the sample to make errors. The reflection coefficient at that signal source is called a "source match".

Frequency tracking : Is the frequency characteristics of the measurement system including the cable and connector.

7.5.4 2-Port Full Calibration (R3765CG/67CG only)

Calibrates the directivity of two port device forward and inverse direction, source match, load match, frequency tracking and isolation.

All S parameters of 2-port device can be measured with the highest accuracy.

NOTE: If OPT 14 is used, the 2-port full calibration cannot be performed between TEST PORT3 and TEST PORT4.

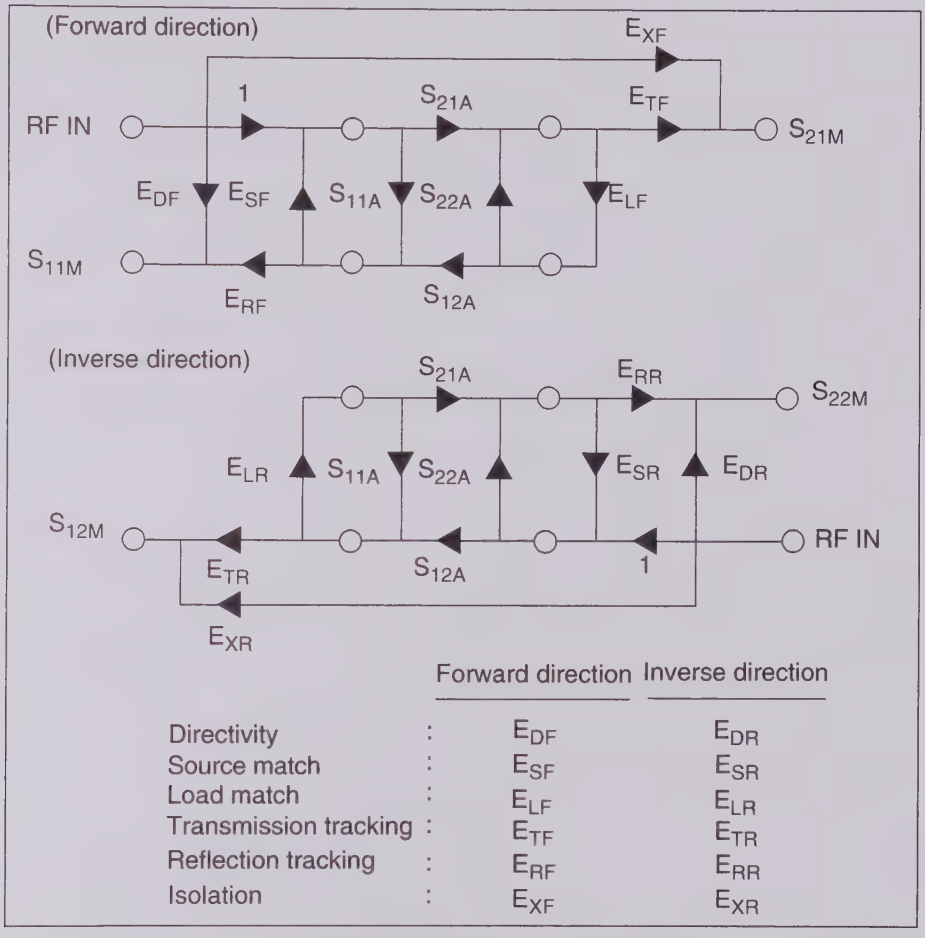
(1) The following four kinds of standard are needed for the calibration.

- Open standard
- Short standard
- Load standard

  * 2 pcs. are needed for the calibration of isolation.
- Through standard

As the characteristics of both directions, forward and inverse, are needed for the execution of calibration, if the characteristic of one of the directions are to be measured, the characteristics of both directions are measured.
Therefore, for S21 measurement, the sweeping is performed twice for the measurement of the forward direction and the inverse direction at the execution of 2-port full calibration.

(2) The following signal flow graph shows an error model.



	Forward direction	Inverse direction
Directivity :	E_{DF}	E_{DR}
Source match :	E_{SF}	E_{SR}
Load match :	E_{LF}	E_{LR}
Transmission tracking :	E_{TF}	E_{TR}
Reflection tracking :	E_{RF}	E_{RR}
Isolation :	E_{XF}	E_{XR}

Directivity : The directional coupler/bridge for measurement of reflection detects a reflection signal from DUT.
But actually it detects not only reflection signal but a little incident signal. The limitation that can separate this reflection signal from the incident signal is called "directivity".

Source match : The error is produced by the reflection signal from DUT which was reflected again from the signal source and then entered into DUT. The reflection coefficient in this signal source is called "source match".

Load match : The signal passed through DUT is input into the receiver section, where the signal is reflected according to the reflection coefficient of the receiver section.
This reflected signal passes DUT again and returns to the signal source. Then produces an error.
This reflection coefficient in the receiver section is called "load match".

Transmission tracking: It's the measurement frequency characteristics of transmission direction.

Reflection tracking : It's the measurement frequency characteristics of reflection direction.

7.5.5 Calibration Method

(1) Normalizing (transmission)

The Setting and the Explanation

① Setup the R3765/67G series to the transmission measurement.

② Connect a through standard between the measurement ports.

③ Press the **[CAL]** to call the calibration menu (1 of 2). (Refer to section A.4.)

④ Press the *{NORMALIZE (THRU)}*.

The message "Wait for Sweep ." is displayed and the calibration data are obtained. The calibration is completed when the message disappears. (Note)

⑤ Connects a sample to perform the measurement.

(2) Normalizing (reflection)

The Setting and the Explanation

① Setup the R3765/67G series to the reflection measurement.

② Connect a open standard or a short standard to the measurement port.

③ Press the **[CAL]** to call the calibration menu (1 of 2). (Refer to section A.4.)

④ When the open standard is used, press the *{NORMALIZE (THRU)}*.

When the short standard is used, press the *{NORMALIZE (SHORT)}*.

The message "Wait for Sweep ." is displayed and the calibration data are obtained. The calibration ends when the message disappears. (Note)

⑤ Connects a sample to perform the measurement.

Note: ***Do not move the R3765/67G series, the cable, the connector, the standard, and the others during the message "Wait for Sweep ." is displayed.***
When the set condition is changed during the message is displayed, the message "Calibration aborted ." is displayed and the current calibration data cannot be acquired.

(3) Normalize & isolation calibration

The Setting and the Explanation

① Set the instrument to the transmission measurement mode.

② Press **[CAL]** to call the calibration menu (1/2).

③ Press *{CAL MENU}* to call the calibration selection menu.

④ Press *{2 PORT CAL MENU}* to call the 2-port calibration selection menu.

⑤ Press *{NORMALIZE & ISO'N}* to call the normalization and isolation calibration menu.

⑥ Connect the through standard between the test ports and press *{THRU}*.

The message "Wait for Sweep ." is displayed and the calibration data is obtained. The calibration is completed when the message disappears. (Note)

⑦ Connect the load standard to each test port and press *{ISOLATION}*.

The message "Wait for Sweep ." is displayed and the calibration data is obtained. The calibration is completed when the message disappears. (Note)

⑧ Press *{DONE NORM & ISO}* to complete the calibration of the normalize & isolation calibration.

⑨ Connect DUT to perform the measurement.

Note: ***Do not move the R3765/67G series, the cable, the connector, the standard, and the others when the message "Wait for Sweep ." is displayed.***
When the set condition is changed during the message is displayed, the message "Calibration aborted ." is displayed and the current calibration data cannot be acquired.

(4) 1-port full calibration

The Setting and the Explanation

① Set the instrument to the reflection measurement mode.

② Press **[CAL]** to call the calibration menu (1/2).

③ Press *{CAL MENU}* to call the calibration selection menu.

④ Press the *{1PORT FULL CAL}* to select the 1-port full calibration selection menu and call the 1-port full calibration menu.

⑤ Connect the open standard to the measurement port and press the *{OPEN}*.

The message "Wait for Sweep ." is displayed and the calibration data are obtained. The calibration is completed when the message disappears. (Note)

⑥ Connect the short standard to the measurement port and press the *{SHORT}*.

The message "Wait for Sweep ." is displayed and the calibration data are obtained. The calibration is completed when the message disappears. (Note)

⑦ Connect the load standard to the measurement port and press the *{LOAD}*.

The message "Wait for Sweep ." is displayed and the calibration data are obtained. The calibration is completed when the message disappears. (Note)

⑧ Press the *{DONE 1-PORT}* to complete the 1-port full calibration.

⑨ Connect a sample to perform the measurement.

CAUTION!

1. ***When calibration data has already been obtained, set the calibration setting to OFF and clear the data, then restart the calibration. The full calibration operation cannot be performed to prevent the calibration data loss by miss operation during the calibration or if the data existed. (Refer to sub-section 7.5.10.)***
2. ***Each calibration data can be obtained again before pressing the*** *{DONE 1-PORT}*.
3. ***When the sweep condition is changed before*** *{DONE 1-PORT}* ***pressed, the message "Calibration canceled !" is displayed and the calibration data is cleared.***

Note: ***Do not move the R3765/67G series, the cable, the connector, the standard, and the others when the message "Wait for Sweep ." is displayed.***
When the set condition is changed during the message is displayed, the message "Calibration aborted ." is displayed and the current calibration data cannot be acquired.

(5) 2-port full calibration (between the TEST PORT1 and the TEST PORT2)

* It can be performed only with R3765CG/67CG.

The Setting and the Explanation

① Press **[CAL]** to call the calibration menu (1 of 2). (Refer to section A.4.)

② Press *{CAL MENUS}* to call the calibration selection menu.

③ Press *{2 PORT CAL MENU}* to call the 2-port calibration menu (For OPT14).

④ Press *{2 PORT CAL MENU}* to call the 2-port calibration selection menu.

⑤ Pressing *{2 PORT FULL CAL}* selects the 2-port calibration to call the 2-port full calibration menu.

CAUTION!

1. ***When calibration data has already been obtained, set the calibration setting to OFF and clear the measurement data, then restart the calibration.***
   During the calibration or if the data exists, the full calibration operation cannot be performed the measurement operation to prevent the calibration data loss by miss operation. (Refer to sub-section 7.5.10.)
2. ***When the sweep condition is changed before*** *{DONE 2-PORT}* ***pressed, the message "Calibration canceled !" is displayed and the calibration data is cleared.***

⑥ Press *{REFLECT'N}* to call the 2-port reflection menu.

⑦ Connect the open standard to port 1 (forward direction reflection measurement port) and press *{S11 (PORT1) FWD:OPEN}*.

The message "Wait for Sweep ." is displayed and the calibration data is obtained. The calibration is completed when the message disappears. (Note)

⑧ Connect the short standard to port 1 (forward direction reflection measurement port) and press *{S11 (PORT1) FWD:SHORT}*.
The message "Wait for Sweep ." is displayed and the calibration data is obtained. The calibration is completed when the message disappears. (Note)

Note: ***Do not move the R3765/67G series, the cable, the connector, the standard, and the others during the message "Wait for Sweep ." is displayed.***
When the set condition is changed during the message is displayed, the message "Calibration aborted ." is displayed and the current calibration data cannot be acquired.

⑨ Connect the load standard to port 1 (forward direction reflection measurement port) and press *{S11 (PORT1) FWD:LOAD}*.
The message "Wait for Sweep ." is displayed and the calibration data is obtained. The calibration is completed when the message disappears.

⑩ Connect the open standard to port 2 (inverse direction reflection measurement port) and press *{S22 (PORT2) REV:OPEN}*.
The message "Wait for Sweep ." is displayed and the calibration data is obtained. The calibration is completed when the message disappears.

⑪ Connect the short standard to port 2 (inverse direction reflection measurement port) and press *{S22 (PORT2) REV:SHORT}*.
The message "Wait for Sweep ." is displayed and the calibration data is obtained. The calibration is completed when the message disappears.

⑫ Connect the load standard to port 2 (inverse direction reflection measurement port) and press *{S22 (PORT2) REV:LOAD}*.
The message "Wait for Sweep ." is displayed and the calibration data is obtained. The calibration is completed when the message disappears.

⑬ Pressing *{DONE REFLECT'N}* executes the reflection calibration.
When the reflection calibration is completed, returns to the 2-port full calibration menu.

CAUTION!
The calibration data of each calibration standard can be acquired again before *{DONE REFLECT'N}* ***pressed.***

⑭ Press *{TRANSMISSION}* to call the 2-port transmission menu.

⑮ Connect the through standard between port 1 and port 2.

⑯ Press *{GROUP THRU}*.
The message "Wait for Sweep ." is displayed and the calibration data is obtained. The calibration is completed when the message disappears. (Note)
When this operation is performed, the following operation of step ⑯ to ⑲ is not necessary.

⑰ Press *{FWD.TRANS THRU}*.
The message "Wait for Sweep ." is displayed and the calibration data is obtained. The calibration is completed when the message disappears. (Note)

⑱ Press *{FWD.MATCH THRU}*.
The message "Wait for Sweep ." is displayed and the calibration data is obtained. The calibration is completed when the message disappears. (Note)

⑲ Press *{REV.TRANS THRU}*.
The message "Wait for Sweep ." is displayed and the calibration data is obtained. The calibration is completed when the message disappears. (Note)

⑳ Press *{REV.MATCH THRU}*.
The message "Wait for Sweep ." is displayed and the calibration data is obtained. The calibration is completed when the message disappears. (Note)

㉑ Pressing *{DONE TRANS}* executes transmission calibration.
Returns to 2-port calibration menu when the transmission calibration is completed.

CAUTION!
The calibration data of each calibration standard can be acquired again before *{DONE TRANS}* ***pressed.***

㉒ Press *{ISOLATION}* to call the 2-port isolation menu.

㉓ In case the isolation omitted.
Press *{OMIT ISOLATION}* and then *{DONE ISOLATION}*.

Isolation calibration

(a) Connect the load standard to port 1 and port 2.

(b) Press *{FMD ISOL'N}*.
The message "Wait for Sweep ." is displayed and the calibration data is obtained.
The calibration is completed when the message disappears.

(c) Press *{REV ISOL'N}*.
The message "Wait for Sweep ." is displayed and the calibration data is obtained.
The calibration is completed when the message disappears.

㉔ Press *{DONE ISOLATION}*.
Executes the isolation calibration and returns to the 2-port full calibration menu.

CAUTION !
The calibration data of each calibration standard can be acquired again before *{DONE ISOLATION}* ***pressed.***

㉕ Press *{DONE 2-PORT}*.
Executes 2-port full calibration.

7.5.6 Interpolating Calibration Data

When *{INTERPOLATE ON/OFF}* is set to ON, the calibration data is performed the interpolation error correction measurement even if the stimulus setting shown below is changed during error correction measurement (during calibration).

- Change of the sweep range (within the calibration range)
- Change of the sweep type (within the constraints)
- Change of the sweep point number

Table 7-1 Combination of Interpolatable Sweep Type (o; possible, x; impossible)

Sweep type under calibration / The sweep type at the present	Linear Sweep	Log Sweep	User Sweep	Program Sweep	Power Sweep
Linear Sweep	○	×	×	×	×
Log Sweep	○	○	×	×	×
User Sweep	○	×	×	×	×
Program Sweep	○	×	×	×	×
Power Sweep	○ *1	×	×	×	○ *2

*1: Obtain the calibration data (1 point) corresponding to CW frequency from the linear sweep frequency range at the calibration and make all the points to the same calibration data.

*2: Compensate with the output level only when CW frequency is the same.

The status display beside the scale showing the calibration status shows the following meaning.

Table 7-2 Status Display

	Normalize	Normalize & Isolation	1-port calibration	2-port calibration	3-port calibration	4-port calibration
Normal correction	"Cor"	"Cor"	"Cor"	"C2"	"C3"	"C4"
Interpolative correction	"C?"	"C?"	"C?"	"C2?"	"C3?"	"C4?"
Abnormal correction	"C!"	"C!"	"C!"	"C2!"	"C3!"	"C4!"

Normal correction	:	When all the setting conditions are the same as of the calibration data acquired.
Interpolative correction	:	When the interpolation is possible and it is performed though the setting conditions are different.
Abnormal correction	:	When the setting conditions are different and the calibration data which is acquired with interpolation of impossible is used as it is.

CAUTION!
When the interpolation is impossible, the sweep range is out of the calibration, or the setting is INTERPOLATE OFF, "C!" is displayed and the acquired calibration data is used as it is.
But when the following setting is made, the calibration (CORRECT) is switched to OFF, and it becomes impossible to switch ON the calibration (CORRECT) again.

(1) When the number of points are changed and furthermore the sweep range is out of the calibration range.

(2) When the setting is made as shown by × in Table 7-1 of the previous page.

(3) When the setting of CW frequency is out of the calibration range in the setting of *1 in Table 7-1.

7.5.7 Calibration Kit Selection

Select CAL KIT when the calibration is performed.

The Setting and the Explanation

① Press **[CAL]** to call the calibration menu (1 of 2). (Refer to section A.4.)

② Press *{CAL MENUS}* to call the selection menu of full calibration.

③ Press *{CAL KIT}* to call the cal kit menu. (See step ④.)

④ Cal kit menu

{N (50Ω)}	:	Compensate the error of N type 50Ω connector open capacity and electrical length. Calls FEMAL/MAL selection menu. (See step ⑤.)
{N (75Ω)}	:	Compensate the error of N type 75Ω connector open capacity and electrical length. Calls FEMAL/MAL selection menu. (See step ⑤.)
{3.5mm}	:	Compensate the error of 3.5mm connector open capacity and electrical length. Calls FEMAL/MAL selection menu. (See step ⑤.)
{7mm}	:	Compensate the error of 7mm connector open capacity and electrical length. The 7mm connecter does not have distinction of FEMAL and MAL.
{USER DEFINE}	:	Corrects an error of the open capacitance and the electric length specified by users. Use *{DEFINE STANDARD}* to specify parameters and call the user specification menu. (Refer to sub-section 7.5.8.)

{DON'T CARE} : It is used when error correction is not performed with the connector.

{DEFINE STANDARD} : Calls the user specification menu.
When using an user selected calibration kit, its parameters should be entered. (Refer to sub-section 7.5.8.)

⑤ FEMAL/MAL selection menu

{PORT 1 FEMAL/MAL} : Sets FEMAL/MAL of the port 1 connector.

{PORT 2 FEMAL/MAL} : Sets FEMAL/MAL of the port 2 connector.

{PORT3 FEMAL/MAL} : Sets the PORT3 connector to FEMAL or MAL.
* This is available when OPT11 (Built-in 3-port test set) or OPT14 (Built-in 4-port test set) is installed.

{PORT4 FEMAL/MAL} : Sets the PORT4 connector to FEMAL or MAL.
* This is available when OPT11 (Built-in 3-port test set) or OPT14 (Built-in 4-port test set) is installed.

CAUTION!
The setting of the cal kit is effective in 1 port and 2 port full calibration.
As the correction data is calculated by using this set parameter when {DONE} is pressed at each calibration, if the setting of cal kit is changed after the {DONE} pressed, it has no effect on the calibration.

7.5.8 Parameters Entry of an User-selected Calibration Kit

This function sets the parameters of an user-selected calibration kit.

(1) Open standard

The electric length between the calibration part and the opening part, and the open capacitance can be entered.
The open capacitance is determined with C_0, C_1, C_2 and C_3 shown in the following equation.

$$\text{Open capacitance} = C_0 + C_1 f + C_2 f^2 + C_3 f^3 \qquad \text{(f: frequency)}$$

The open capacitance is a frequency function and can be extended as the equation shown above.

(2) Short standard

The electric length between the calibration part and the short part can be entered.

(3) Through standard

Electric length, loss and impedance can be entered. Loss should be entered the resistance per unit length of the through standard.
The units of the parameters are expressed as follows:

Electric length	(OFFSET DELAY)	[sec]
Loss	(OFFSET LOSS)	[Ω/sec]
Impedance	(OFFSET Z_0)	[Ω]

Open capacitance	(OPEN C_0)	[10^{-15}F]
	(OPEN C_1)	[10^{-27}F/Hz]
	(OPEN C_2)	[10^{-36}F/Hz^2]
	(OPEN C_3)	[10^{-45}F/Hz^3]

The unit, [sec] is converted to the unit [m], multiplied by the speed of light.

The Setting and the Explanation

① Press the **[CAL]** to call the calibration menu (1 of 2).

② Press *{CAL MENUS}* to call the full calibration selection Menu.

③ Press *{CAL KIT}* to call the calibration kit menu.

④ Press *{DEFINE STANDARD}* to call the user selection menu.

⑤ User specifying menu

{PORT1 REFL.STD} : Enters the parameter of the open standard to be connected to Port 1.
calls the open standard entry menu. (See step ⑥.)

{PORT2 REFL.STD} : Enters the parameter of the open standard to be connected to Port 2.
Calls the open Standard entry menu. (See step ⑥.)

{PORT3 REFL STD} : Enters the parameter of the open standard that is connected to PORT3.
Calls the OS entry menu. (See step ⑥.).

* This is available when OPT11 (Built-in 3-port test set) or OPT14 (Built-in 4-port test set) is installed.

{PORT4 REFL STD} : Enters the parameter of the open standard that is connected to PORT4.
Calls the OS entry menu. (See step ⑥.).

* This is available when OPT14 (a built-in 4-port test set) is installed.

{P1 ~ P2 THRU.STD} : Enters the parameters of the through standard to be connected between Port 1 and Port 2.
Calls the offset entry menu. (See step ⑦.)

{P1 ~ P3 THRU.STD} : Enters the parameters of the through standard to be connected between Port 1 and Port 3.
Calls the offset entry menu. (See step ⑦.)

* This is available when OPT11 (Built-in 3-port test set) or OPT14 (Built-in 4-port test set) is installed.

{P2 ~ P3 THRU.STD} : Enters the parameters of the through standard to be connected between Port 2 to Port 3.
Calls the offset entry menu. (See step ⑦.)

* This is available when OPT11 (Built-in 3-port test set) or OPT14 (Built-in 4-port test set) is installed.

{P1 ~ P4 THRU.STD} : Enters the parameters of the through standard to be connected between Port 1 to Port 4.
Calls the offset entry menu. (See step ⑦.)

* This is available when OPT11 (Built-in 3-port test set) or OPT14 (Built-in 4-port test set) is installed.

{P2 ~ P4 THRU.STD} : Enters the parameters of the through standard to be connected between Port 2 to Port 4.
Calls the offset entry menu. (See step ⑦.)

* This is available when OPT11 (Built-in 3-port test set) or OPT14 (Built-in 4-port test set) is installed.

{P3 ~ P4 THRU.STD} : Enters the parameters of the through standard to be connected between Port 3 to Port 4.
Calls the offset entry menu. (See step ⑦.)

* This is available when OPT11 (Built-in 3-port test set) or OPT14 (Built-in 4-port test set) is installed.

{SAVE TO USER DEFINE}: Saves the parameters entered.
calls the saving menu. (See step ⑧.)

⑥ Open standard entry menu

{OPEN C0} : Enters the open capacitance, C_0.

{OPEN C1} : Enters the open capacitance, C_1.

{OPEN C2} : Enters the open capacitance, C_2.

{OPEN C3} : Enters the open capacitance, C_3.

{OPEN OFFSET} : Enters the electric length of the open standard.
Calls the offset entry menu. (See step ⑦.)

{SHORT OFFSET} : Enters the electric length of the short standard.
Calls the offset entry menu. (See step ⑦.)

⑦ Offset entry menu

{OFFSET DELAY} : Enters the electric length of the open/short/through standard.

{OFFSET LOSS} : Enters the loss of the through standard.

{OFFSET Z0} : Enters the impedance of the through standard.

⑧ Saving menu

{YES} : Saves the parameters of the calibration kit.

{NO} : Does not save the parameters of the calibration kit.

7.5.9 Extending Measurement Reference Plane

Is the function which moves the calibration plane to the end of the cable when the extension cable is connected to the test port after calibration. The function calibrates the addition of the electrical length, assuming that the cable having no loss completely has been added. That is, it obtains the phase characteristics only for a sample by calibrating the phase shift for the addition.

- Electrical length correction
  Corrects the electrical length which has been set to the measurement data. The measurement port type is not identified. It can be used not only for correction but also measuring the electrical length of the cable. Also, it can be used to measure flatness of the phase by removing phase change due to the electrical length of the actual sample.
- Port extension
  Measurement is made, assuming that the extension cable with the electrical length already set is connected to the measurement port. That is, the electrical length already set is automatically corrected according to the change of the measurement port. For example, if a correction value 10ns is set to the port 1 and a value 20ns is set to the port 2 when S parameter test-set is used, the correction is automatically made as follows:

  For S_{11} measurement: (PORT 1) × 2=20ns
  For S_{21} measurement: (PORT 1)+(PORT 2)=30ns
- Phase offset
  This function does not correct the electrical length. It adds a constant phase value as an offset regardless of the frequency.
- Phase slope
  This function corrects and displays slope of the data measured by phase measurement. The phase of the stop frequency is corrected by an input value with reference to the phase of the start frequency.
- Velocity factor (V_f)
  Sets the transfer constant value to be used to calculate the electrical length. The initial setting is V_f=1.

$$V_f = \frac{1}{(\varepsilon_R)^{1/2}}$$

- Phase offset value/correction value

$$\Phi(\text{deg}) = \frac{L}{c} \times \frac{1}{V_f} \times f \times 360$$
$$= S \times f \times 360$$

V_f	:	Velocity factor
L	:	Electrical length (distance)
c	:	Light speed
S	:	Electrical length (time)
f	:	Frequency
ε_R	:	Relative permittivity

The Setting and the Explanation

- Calibration menu (1 of 2 and 2 of 2) includes the menu with which the reference plane is extended.

① Press the **[CAL]** to call the calibration menu (1 of 2). (Refer to section A.4.)

{PORT EXTENSION} : Calls the port extension menu. (See step ④.)

② Press the *{More 1/2}* to call the calibration menu (2 of 2).

③ Calibration menu (2 of 2)

{ELEC DELAY ON/OFF} : Selects ON/OFF of the electrical length correction.

{ELECTRICAL DELAY} : Sets the correction value for the electrical length in a unit of time.

{ELECTRICAL LENGTH} : Sets the correction value for the electrical length in a unit of distance.

{VELOCITY FACTOR} : Sets the velocity factor value.

{PHASE OFFSET VALUE} : Sets the phase offset value.

{PHASE SLOPE} : Sets the phase slope value.

④ Port extension menu

- For R3765BG/67BG, R3765CG/67CG

{EXTENSION ON/OFF} : Selects ON/OFF of the port extension.

{EXTENSION INPUT A} : Sets the value of the A input port A extension by time.

{EXTENSION INPUT B} : Sets the value of the B input port B extension by time.

{EXTENSION PORT 1} : Sets the value of the S parameter test-set port 1 extension by time.

{EXTENSION PORT 2} : Sets the value of the S parameter test-set port 2 extension by time.

{MARKER→EXTENSION}: Sets the measured value by the active marker as a port extension value in the reflection wave measurement.

- For R3765CG/67CG, OPT11

{EXTENSION ON/OFF} : Selects ON/OFF of the port extension.

{EXTENSION INPUT A} : Sets the value of the A input port A extension by time.

{EXTENSION INPUT B} : Sets the value of the B input port B extension by time.

{EXTENSION INPUT C} : Sets the value of the C input port C extension by time.

{EXTENSION PORT 1} : Sets the value of the S parameter test-set port 1 extension by time.

{EXTENSION PORT 2} : Sets the value of the S parameter test-set port 2 extension by time.

{EXTENSION PORT 3} : Sets the value of the S parameter test-set port 3 extension by time.

{MARKER→EXTENSION}: Sets the measured value by the active marker as a port extension value in the reflection wave measurement.

- For R3765CG/67CG, OPT14

  {EXTENSION PORT 1} : Sets the value of the S parameter test-set port 1 extension by time.

  {EXTENSION PORT 2} : Sets the value of the S parameter test-set port 2 extension by time.

  {EXTENSION PORT 3} : Sets the value of the S parameter test-set port 3 extension by time.

  {EXTENSION PORT 4} : Sets the value of the S parameter test-set port 4 extension by time.

  {MARKER→EXTENSION}: Sets the measured value by the active marker as a port extension value in the reflection wave measurement.

- For R3765AG/67AG

  {EXTENSION ON/OFF} : Selects ON/OFF of the port extension.

  {EXTENSION INPUT A} : Sets the value of the input port A extension by time.

  {EXTENSION INPUT B} : Sets the value of the B input port B extension by time.

7.5.10 Calibration Data Clear

Once the calibration operation is executed, the *{CORRECT ON/OFF}* which indicates the calibration being executed is set to ON. For re-calibration, the calibration data must be cleared.

Note: ***Re-calibration operations differ between the case of normalize and the case of normalize & isolation calibration and full calibration.***

(1) For normalize

Whether calibrated or not, the data is re-calibrated by pressing the *{NORMALIZE}*.

Note: ***The normalize calibration data is overwritten by the re-calibration operation so that the function for clearing the calibration data is not provided.***

(2) The case of normalize & isolation calibration and full calibration

If the calibration data of the normalize & isolation calibration and full calibration has already been existed, in either case the calibration ON or OFF, the re-calibration cannot be executed. To re-calibrate the data, the data must be cleared.
The calibration data cannot be cleared during the calibration operation in order to prevent miss operation. But if the sweeping condition is changed during the calibration, the data can be cleared forcefully because the sweeping condition of each acquired calibration data is changed.

The Setting and the Explanation

① Press the **[CAL]** to call the calibration menu (1 of 2). (Refer to section A.4.)

② Sets the *{CORRECT ON/OFF}* to OFF.

③ Press the *{CAL MENUS}* to call the full-calibration selection menu.

④ Press the *{CLEAR CAL DATA}* to call the clearing menu.

⑤ Press the *{YES}* to clear the calibration data.

⑥ Select any one of 1-port/2-port full calibration and enter the calibration operation.

CAUTION!
If the *{CORRECT ON/OFF}* ***is set to OFF, unless the calibration data is not cleared, the calibration can be set to ON again.***

7.5.11 3-Port Full Calibration

This function calibrates the directivity, source matching, load matching, frequency tracking, and isolation for a 3-port device.

This calibration method can be used only for the R3765CG and R3767CG equipped with OPT11 (built-in 3-port), OPT13 (Impedance: 75Ω, built-in 3-port) or OPT14 (4-port test set) individually.

There are two possible combinations for 3-port full calibrations as listed below when using OPT 14 with the R3765CG or R3767CG.

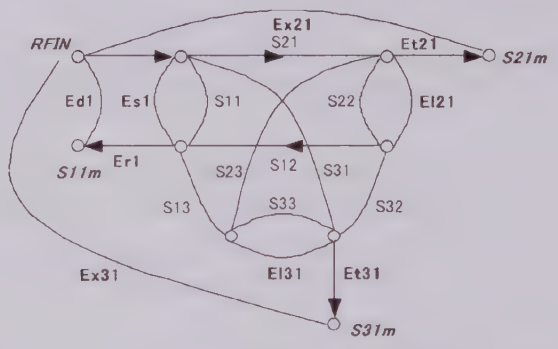
1. PORT1-PORT2-PORT3
2. PORT1-PORT2-PORT4

(1) The following four calibration standards are necessary:

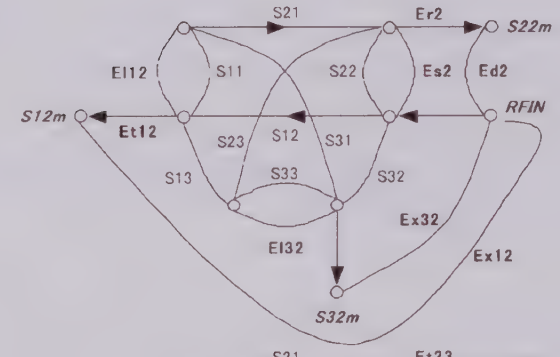
- Open standard
- Short standard
- Load standard
  * Two load standards are necessary for performing isolation calibration.
- Through standard

(2) The signal-flow graphs below show error models
(When the ports are connected in order of PORT1, PORT2 and PORT3).

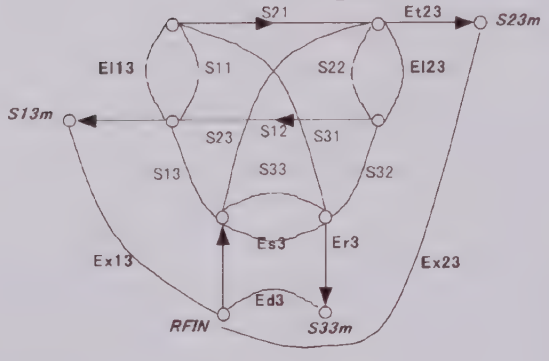
- PORT1 signal source



- PORT2 signal source



- PORT3 signal source



Signal source	PORT1	PORT2	PORT3
Directivity	E_{d1}	E_{d2}	E_{d3}
Source matching	E_{s1}	E_{s2}	E_{s3}
Load matching	E_{l21},E_{l31}	E_{l12},E_{l32}	E_{l13},E_{l23}
Transmission tracking	E_{t21},E_{t31}	E_{t12},E_{t32}	E_{t13},E_{t23}
Reflection tracking	E_{r1}	E_{r2}	E_{r3}
Isolation	E_{x21},E_{x31}	E_{x12},E_{x32}	E_{x13},E_{x23}

* $E_{l21}=E_{l23}$
$E_{l32}=E_{l31}$
$E_{l13}=E_{l12}$

Directivity	A directivity coupler or a directivity bridge used for reflection measurement detects the reflected signal from the test device. However, it not only detects the reflected signal but also a small amount of the incident signal. The limit between separating the incident signal and the reflected signal is referred to as Directivity.
Source Matching	The reflected signal from the test device is reflected again at the signal source, which causes an incident error to the test device. This reflection coefficient at the signal source is referred to as Source Matching.
Load Matching	The signal that passed through the test device is input into the receiver section. Depending on the reflection coefficient of the receiver section, the signal is reflected at the receiver section. This reflected signal passes through the test device again and returns to the signal source, causing an error. This reflection coefficient of the receiver section is referred to as Load Matching.
Transmission Tracking	This is the measurement frequency transmission characteristic.
Reflection Tracking	This is the measurement frequency reflection characteristic.

Even while the measurement between TEST PORT1 and TEST PORT2 is being performed, the 3-port full calibration makes a complete error correction for the 3-port network and corrects the error caused by TEST PORT 3.
That is, it corrects the effect caused by the reflection from TEST PORT3.
In the same way, it corrects the error caused by TEST PORT2, while the measurement between TEST PORT1 and TEST PORT3 is being performed. It also corrects the error caused by TEST PORT1 while the measurement between TEST PORT2 and TEST PORT3 is being performed.

However, when the 3-port full calibration is carried out, the measurements are always performed for all three directions. For example, when the measurement between TEST PORT1and TEST PORT2 is performed, the measurement between TEST PORT1 and TEST PORT3 and the measurement between TEST PORT2 and TEST PORT3 are also carried out.

(3) Operation and description (3-port calibration of PORT1, PORT2 and PORT3)

① Press **[CAL]** to call the calibration menu (1/2).

② Press *{CAL MENU}* to call the full calibration selection menu.

③ <For OPT11/13>
When *{3 PORT FULL CAL}* is pressed, the 3-port calibration is selected, then the 3-port full calibration menu is displayed.

<For OPT14>
Press *{3PORT CAL MENU}* to display the 3 port cal menu.

When *{P1-P2-P3 FULL CAL}* is pressed, the 3-port calibration of PORT1, PORT2 and PORT3 is selected, then the 3-port full calibration menu is displayed.

Notes:

1. ***After calibration has been performed, turn the calibration off, clear the previous calibration data and start the 3-port full calibration. If calibration is being executed or calibration data exists, calibration operation is disabled to prevent erroneous operation from occurring and causing the calibration data to be deleted. (Refer to Section 7.5.10.)***

2. ***If the sweep conditions are changed before {DONE 3-PORT} is pressed, a message "Calibration canceled !" is displayed and the calibration data is cleared.***

④ Press *{PORT1 REFLECT'N}* to call the PORT1 reflection menu.

⑤ Connect the open standard to TEST PORT1, then press *{S11 (PORT1) OPEN}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑥ Connect the short standard to TEST PORT1, then press *{S11 (PORT1) SHORT}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑦ Connect the load standard to TEST PORT1, then press *{S11 (PORT1) LOAD}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑧ Press *{DONE PORT1 REFLECT'N}* to execute the reflection calibration for TEST PORT1.
When the reflection calibration for TEST PORT1 has been completed, the 3-port full calibration menu is resumed.

⑨ Press *{PORT2 REFLECT'N}* to call the PORT2 reflection menu.

⑩ Connect the open standard to TEST PORT2, then press *{S22 (PORT2) OPEN}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑪ Connect the short standard to TEST PORT2, then press *{S22 (PORT2) SHORT}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑫ Connect the load standard to TEST PORT2, then press *{S22 (PORT2) LOAD}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑬ Press *{DONE PORT2 REFLECT'N}* to execute the reflection calibration for TEST PORT2.
When the reflection calibration for TEST PORT2 has been completed, the 3-port full calibration menu is resumed.

⑭ Press *{PORT3 REFLECT'N}* to call the PORT3 reflection menu.

⑮ Connect the open standard to TEST PORT3, then press *{S33 (PORT3) OPEN}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑯ Connect the short standard to TEST PORT3, then press *{S33 (PORT3) SHORT}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑰ Connect the load standard to TEST PORT3, then press *{S33 (PORT3) LOAD}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑱ Press *{DONE PORT3 REFLECT'N}* to execute the reflection calibration for TEST PORT3.
When the reflection calibration for TEST PORT3 has been completed, the 3-port full calibration menu is resumed.

Note: ***It is possible to retrieve calibration data for each calibration standard if {DONE PORT1 REFLECT'N}, {DONE PORT2 REFLECT'N}, and {DONE PORT3 REFLECT'N} have not been pressed yet.***

⑲ Press *{TRANSMISSION}* to call the transmission menu.

⑳ Connect the through standard between TEST PORT1 and TEST PORT2, then call *{P1-P2 THRU}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

㉑ Connect the through standard between TEST PORT1 and TEST PORT3, then call *{P1-P3 THRU}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

㉒ Connect the through standard between TEST PORT2 and TEST PORT3, then call *{P2-P3 THRU}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

㉓ Press *{DONE TRANS}* to execute the transmission calibration.
When the transmission calibration has been completed, the 3-port full calibration menu is displayed.

Note ***It is possible to retrieve calibration data for each calibration standard if {DONE TRANS} has not been pressed yet.***

㉔ Press *{ISOLATION}* to call the isolation menu.

㉕ To omit the isolation calibration, press *{OMIT ISOLATION}*, then press *{DONE ISOLATION}*.:

Follow directions below to execute the isolation calibration:

(25-A)Connect the load standard between TEST PORT1 and TEST PORT2, then press *{P1-P2 ISOLATION}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

(25-B) Connect the load standard between TEST PORT1 and TEST PORT3, then press *{P1-P3 ISOLATION}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

(25-C) Connect the load standard between TEST PORT2 and TEST PORT3, then press *{P2-P3 ISOLATION}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

(25-D)Press *{DONE ISOLATION}* to execute the isolation calibration.
When the isolation calibration has been completed, the 3-port full calibration menu is displayed.

Note: ***It is possible to retrieve calibration data for each calibration standard if {DONE ISOLATION} has not been pressed yet.***

㉖ Press *{DONE 3-PORT}* to execute the 3-port full calibration.

Note: ***Do not move the instrument, connected cables, connectors, or calibration standard while the message "Wait for Sweep ." is displayed.***
If the set conditions are changed while the message is displayed, the "Calibration aborted ." message is displayed, and calibration data cannot be retrieved during that time.

(4) Interpolation of 3-port calibration data

When *{INTERPOLATE ON/OFF}* is set to ON, the calibration data is interpolated even if the following stimulus settings are changed during the error correction measurement (calibration).

- Change of the sweep range (within the calibration range only)
- Change of the sweep type (with some restrictions)
- Change of the number of sweep points

For more information on the combination of sweep types available for interpolation, refer to Section 7.5.6, "Interpolating Calibration Data."

While the error correction measurement (calibration) is being performed, symbolic characters are displayed on the left side of the screen to show the calibration status (as listed below).

Normal correction	"C3"
Interpolation correction	"C3?"
Abnormal correction	"C3!"

Normal correction	All set conditions match the ones used for the calibration data acquisition.
Interpolation correction	The set conditions do not match, but interpolation is possible and is being executed.
Abnormal correction	The set conditions do not match, and the acquired calibration data which cannot be interpolated is used as is.

Note: ***When interpolation is impossible, the sweep range is out of the calibration range, or INTERPOLATE is set to OFF, C3! is displayed and the acquired calibration data is used as is. However, if one of the following settings is used, CORRECT is set to OFF and cannot be set to ON.***

(1) The number of measurement points is changed and the sweep range is out of the correction range.

(2) A condition indicated by x on Table 7-1 of Section 7.5.6, "Interpolating Calibration Data" is set.

(3) A condition indicated by *1 on Table 7-1 of Section, 7.5.6 "Interpolating Calibration Data" is set and the CW frequency is out of the correction range.

7.5.12 4-Port Full Calibration

This function calibrates the directivity, source matching, load matching, frequency tracking, and isolation for a 4-port device.

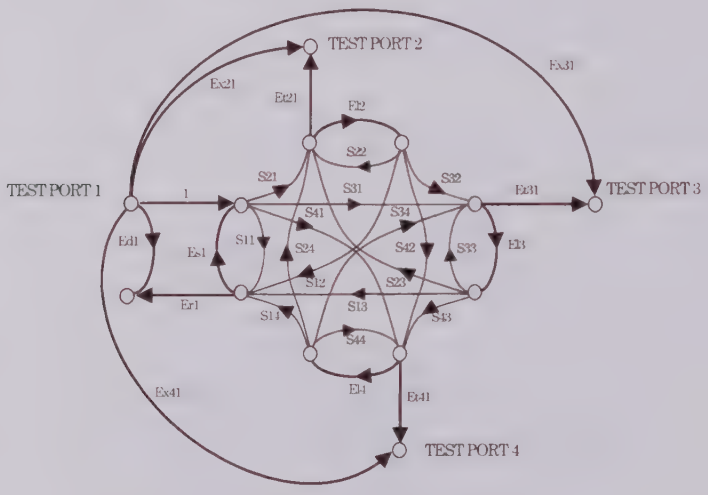
This calibration method can be used only for the R3765CG and R3767CG equipped with OPT14 (4-port test set).

(1) The following four calibration standards are necessary:

- Open standard
- Short standard
- Load standard
  * Two load standards are necessary for performing isolation calibration.
- Through standard

(2) The signal-flow graphs below show error models

- PORT1 signal source



An error term is indicated with the thick line, and an S parameter (S) is indicated with the thin line.
A total of 40 error terms can be defined from an error model consisting of the TEST PORT2, TEST PORT3 and TEST PORT4 signal sources.

Signal source	PORT1
Directivity	Ed1, Ed2, Ed3, Ed4
Source matching	Es1, Es2, Es3, Es4
Load matching	El1, El2, El3, El4
Transmission tracking	Et21, Et31, Et41, Et12, Et32, Et42, Et13, Et23, Et43, Et14, Et24, Et34
Reflection tracking	Er1, Er2, Er3
Isolation	Ex21, Ex31, Ex41, Ex12, Ex32, Ex42, Ex13, Ex23, Ex43, Ex14, Ex24, Ex34

Note: A number in an error term indicates a port number.

Ed1 shows the directivity of TEST PORT1, and Et21 shows the transmission tracking from TEST PORT1 to TEST PORT2.

The 4-port full calibration makes a complete error correction for the 4-port network. As a result, all errors, which refer to all combinations of two ports, are always corrected for, even if the error between PORT1 and PORT2 is measured.

A total of 16 S parameters of a 4-port device is obtained using the following 6 paths: TEST PORT 1 to TEST PORT 2, TEST PORT 1 to TEST PORT 3, TEST PORT 1 to TEST PORT 4, TEST PORT 2 to TEST PORT 3, TEST PORT 2 to TEST PORT 4, and TEST PORT 3 to TEST PORT 4.

(3) Operation and description

① Press **[CAL]** to call the calibration menu (1/2).

② Press *{CAL MENU}* to call the full calibration selection menu.

③ When *{4 PORT FULL CAL}* is pressed, the 4-port calibration is selected, then the 4-port full calibration menu is displayed.

④ Press *{PORT1 REFLECT'N}* to call the PORT1 reflection menu.

⑤ Connect the open standard to TEST PORT1, then press *{S11 (PORT1) OPEN}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑥ Connect the short standard to TEST PORT1, then press *{S11 (PORT1) SHORT}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑦ Connect the load standard to TEST PORT1, then press *{S11 (PORT1) LOAD}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑧ Press *{DONE PORT1 REFLECT'N}* to execute the reflection calibration for TEST PORT1.
When the reflection calibration for TEST PORT1 has been completed, the 4-port full calibration menu is resumed.

Note: ***It is possible to retrieve calibration data for each calibration standard if {DONE PORT1 REFLECT'N} has not been pressed yet.***

⑨ Press *{PORT2 REFLECT'N}* to call the PORT2 reflection menu.

⑩ Connect the open standard to TEST PORT2, then press *{S22 (PORT2) OPEN}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑪ Connect the short standard to TEST PORT2, then press *{S22 (PORT2) SHORT}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑫ Connect the load standard to TEST PORT2, then press *{S22 (PORT2) LOAD}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑬ Press *{DONE PORT2 REFLECT'N}* to execute the reflection calibration for TEST PORT2.
When the reflection calibration for TEST PORT2 has been completed, the 4-port full calibration menu is resumed.

Note: ***It is possible to retrieve calibration data for each calibration standard if {DONE PORT2 REFLECT'N} has not been pressed yet.***

⑭ Press *{PORT3 REFLECT'N}* to call the PORT3 reflection menu.

⑮ Connect the open standard to TEST PORT3, then press *{S33 (PORT3) OPEN}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑯ Connect the short standard to TEST PORT3, then press *{S33 (PORT3) SHORT}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑰ Connect the load standard to TEST PORT3, then press *{S33 (PORT3) LOAD}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

⑱ Press *{DONE PORT3 REFLECT'N}* to execute the reflection calibration for TEST PORT3.
When the reflection calibration for TEST PORT3 has been completed, the 4-port full calibration menu is resumed.

Note: ***It is possible to retrieve calibration data for each calibration standard if {DONE PORT3 REFLECT'N} has not been pressed yet.***

⑲ Press *{PORT4 REFLECT'N}* to call the PORT3 reflection menu.

⑳ Connect the open standard to TEST PORT4, then press *{S44 (PORT4) OPEN}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

㉑ Connect the short standard to TEST PORT4, then press *{S44 (PORT4) SHORT}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

㉒ Connect the load standard to TEST PORT4, then press *{S44 (PORT4) LOAD}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

㉓ Press *{DONE PORT4 REFLECT'N}* to execute the reflection calibration for TEST PORT4.
When the reflection calibration for TEST PORT4 has been completed, the 4-port full calibration menu is resumed.

Note: ***It is possible to retrieve calibration data for each calibration standard if {DONE PORT4 REFLECT'N} has not been pressed yet.***

㉔ Press *{TRANSMISSION}* to call the transmission menu.

㉕ Connect the through standard between TEST PORT1 and TEST PORT2, then call *{P1-P2 THRU}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

㉖ Connect the through standard between TEST PORT1 and TEST PORT2, then call *{P1-P2 THRU}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

㉗ Connect the through standard between TEST PORT2 and TEST PORT3, then call *{P2-P3 THRU}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

㉘ Connect the through standard between TEST PORT1 and TEST PORT4, then call *{P1-P4 THRU}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

㉙ Press *{DONE TRANS}* to execute the transmission calibration.
When the transmission calibration has been completed, the 4-port full calibration menu is displayed.

Note: ***It is possible to retrieve calibration data for each calibration standard if {DONE TRANS} has not been pressed yet.***

㉚ Press *{ISOLATION}* to call the isolation menu.

㉛ To omit the isolation calibration, press *{OMIT ISOLATION}*, then press *{DONE ISOLATION}*.:

When the isolation calibration has been completed, the 4-port full calibration menu is displayed.

Follow directions below to execute the isolation calibration:

(31-A) Connect the load standard between TEST PORT1 and TEST PORT2, then press *{P1-P2 ISOLATION}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

(31-B) Connect the load standard between TEST PORT1 and TEST PORT3, then press *{P1-P3 ISOLATION}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

(31-C) Connect the load standard between TEST PORT2 and TEST PORT3, then press *{P2-P3 ISOLATION}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

(31-D)Connect the load standard between TEST PORT1 and TEST PORT4, then press *{P1-P4 ISOLATION}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

(31-E) Connect the load standard between TEST PORT2 and TEST PORT4, then press *{P2-P4 ISOLATION}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

(31-F) Connect the load standard between TEST PORT3 and TEST PORT4, then press *{P3-P4 ISOLATION}*.
A message "Wait for Sweep ." is displayed and the calibration data is acquired.
When the message disappears, the calibration data acquisition is completed. (Note)

(31-G)Press *{DONE ISOLATION}* to execute the isolation calibration.
When the isolation calibration has been completed, the 4-port full calibration menu is displayed.

Note: ***It is possible to retrieve calibration data for each calibration standard if {DONE ISOLATION} has not been pressed yet.***

㉜ Press *{DONE 4-PORT}* to execute the 4-port full calibration.

7.6 Marker Function

The value of the data displayed can be read out with the marker. Also, the marker can find out the maximum or minimum value and change the settings of the signal source and the display.

Up to ten markers can be set for the sub measure screen of each channel.

One of the ten markers per channel is set to the active marker. The change of the marker setting is made to the active marker.

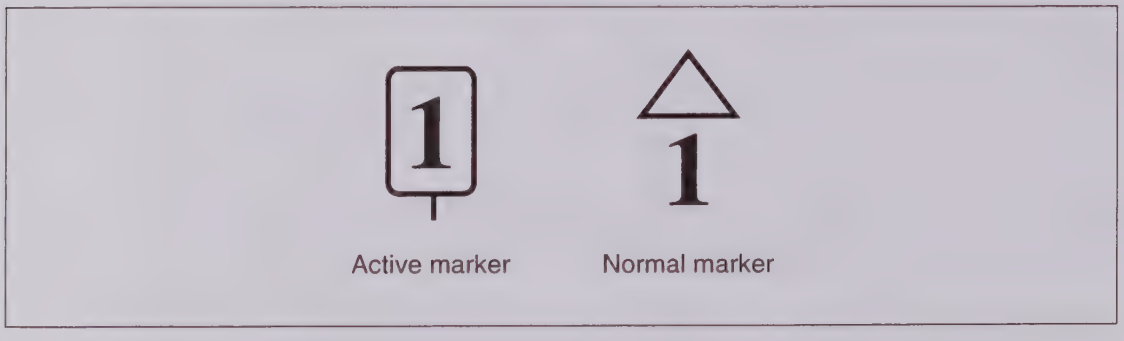
The values on active marker is always displayed in the specified position on the screen.

Also, the marker list function can display all the values of other markers and the active marker at the same time.

[MKR] : Calls a marker menu to set a marker.

[MKR →] : Calls a marker search menu for a marker analysis.

An active marker and a normal marker are shown in the following.



N: Marker number between 1 and 10

7.6.1 Setting Marker

Up to ten markers can be set for each channel and the marker which is displayed at the marker area on the screen is called an "active marker".

This function sets the active marker or changes the marker already set.

The Setting and the Explanation

① Press the **[MKR]** to call the marker menu. (Refer to section A.4.)

② Press the *{ACTIVATE MARKER [ ]}* to call the active marker menu.

③ Active marker menu

- Active marker menu (1 of 2)

{MARKER 1}	:	Sets the marker 1 for the active marker.
{MARKER 2}	:	Sets the marker 2 for the active marker.
{MARKER 3}	:	Sets the marker 3 for the active marker.
{MARKER 4}	:	Sets the marker 4 for the active marker.
{MARKER 5}	:	Sets the marker 5 for the active marker.
{ACTIVATE MKR OFF}	:	Sets off only the active marker. If several markers are set, the marker of the smallest number becomes the active marker.

Only when a marker frequency is displayed in the active area, its marker is controlled with the ten-key and the step key.

- Active marker menu (2 of 2)

{MARKER 6}	:	Sets the marker 6 for the active marker.
{MARKER 7}	:	Sets the marker 7 for the active marker.
{MARKER 8}	:	Sets the marker 8 for the active marker.
{MARKER 9}	:	Sets the marker 9 for the active marker.
{MARKER 10}	:	Sets the marker 10 for the active marker.
{ACTIVATE MKR OFF}	:	Sets off only the active marker.

7.6.2 Marker Coupling between Channels

The R3765/67G series has two channels. The function is used to select if the markers are interlocked between the channels or not.
"Marker interlock between channels" means that the marker which has been set for the active channel is automatically set for the non-active channel regardless of ON/OFF of the dual channel display. "Non-interlock" means that the markers are made to independently operate for each channel.

The Setting and the Explanation

① Press the **[MKR]** to call the marker menu. (Refer to section A.4.)

② Press the *{MARKER MODE MENU}* to call the marker mode menu.

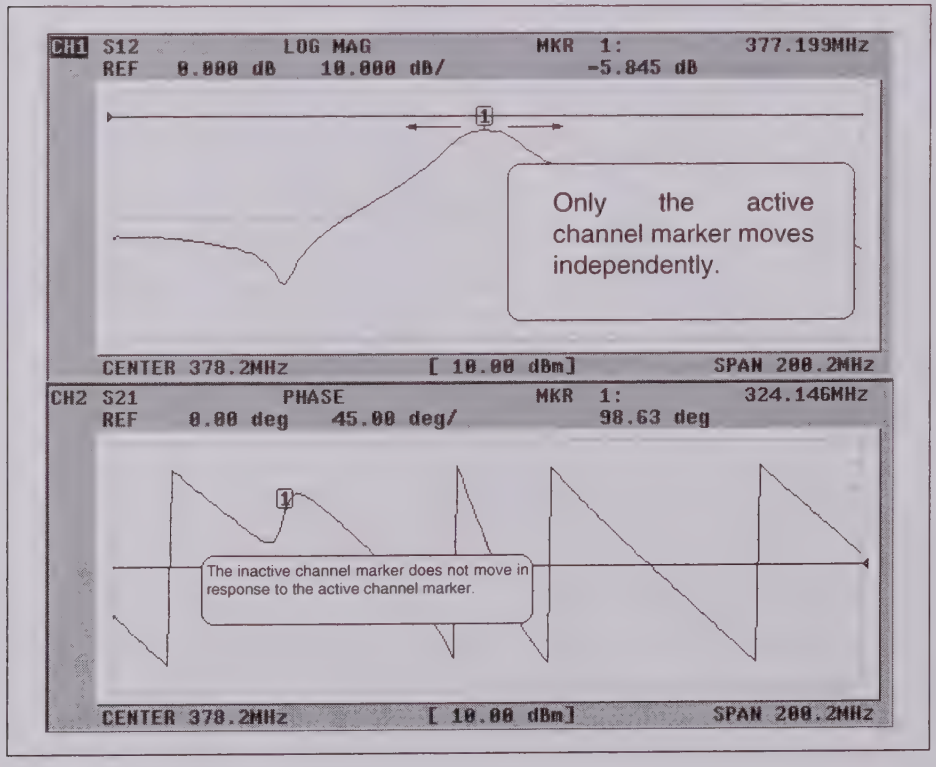
③ Press the *{MKR CPL/UNCPL}* to select the marker coupling between the channels.

CPL : Coupling ON (interlock between channels)
UNCPL : Coupling OFF (non interlock between channels)

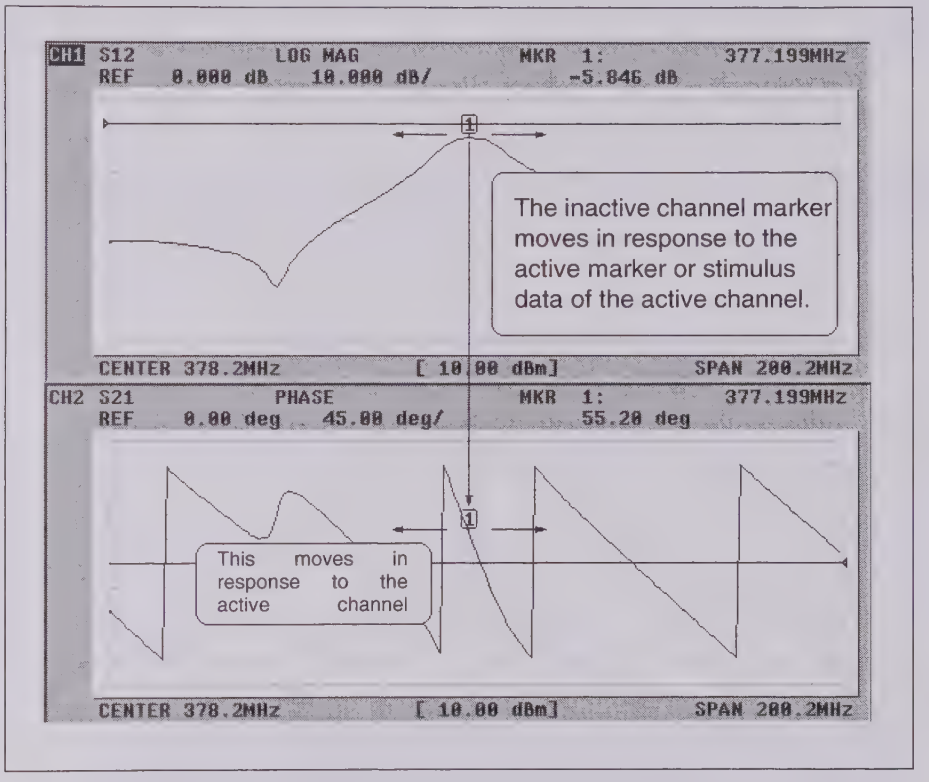
If sweep type satisfies the following conditions, even if the MKR CPL is specified, a marker is not coupled.

- When the sweep type of either of CH1 or CH2 is set to the USER SWEEP or the PROGRAM SWEEP.
- When both a frequency sweep and a level sweep are set simultaneously.
- When CH 1/2 is set to the zero span mode.

<For MKR UNCPL>


CH1 S12 LOG MAG MKR 1: 377.199MHz
REF 0.000 dB 10.000 dB/ -5.845 dB
Only the active channel marker moves independently.
CENTER 378.2MHz [10.00 dBm] SPAN 200.2MHz
CH2 S21 PHASE MKR 1: 324.146MHz
REF 0.00 deg 45.00 deg/ 98.63 deg
The inactive channel marker does not move in response to the active channel marker.
CENTER 378.2MHz [10.00 dBm] SPAN 200.2MHz

<For MKR CPL>


CH1 S12 LOG MAG MKR 1: 377.199MHz
REF 0.000 dB 10.000 dB/ -5.846 dB
The inactive channel marker moves in response to the active marker or stimulus data of the active channel.
CENTER 378.2MHz [10.00 dBm] SPAN 200.2MHz
CH2 S21 PHASE MKR 1: 377.199MHz
REF 0.00 deg 45.00 deg/ 55.20 deg
This moves in response to the active channel
CENTER 378.2MHz [10.00 dBm] SPAN 200.2MHz

7.6.3 Interpolation between Measurement Points

The marker can be assigned to either one mode that sets markers and reads data of each marker by interpolating linearly between measurement points and another mode that sets markers to only actual measurement points.

The Setting and the Explanation

① Press the **[MKR]** to call the marker menu. (Refer to section A.4.)

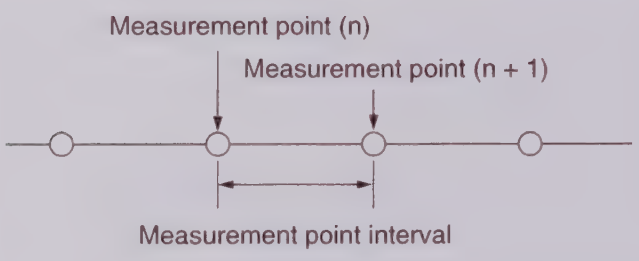
② Press the *{MARKER MODE MENU}* to call the marker mode menu.

③ Interpolation between measurement points is selected by *{MKR CMP/UNCMP}*.

CMP : Interpolation (compensation) ON

UNCMP : Interpolation (compensation) OFF

When the sweep type is set to USER SWEEP/PROG SWEEP, even if CMP is selected, the interpolation possibly don't work depending on the number of set points.



7.6.4 Displaying Marker Read out Value

The marker value displayed on the screen always indicates the active marker. To display more than that marker, use the marker list function to list all set markers at a time.

The marker list has two modes: in one mode, the marker list overlaps the waveform screen and in the other mode, the screen is split into two, and the waveform and marker list are displayed separately.

The Setting and the Explanation

① Press the **[MKR]** to call the marker menu. (Refer to section A.4.)

② Press the *{MKR LIST ON/OFF}* to select ON/OFF of the marker list display.

{SPLIT LIST ON/OFF} : Toggles the split display mode between ON and OFF.
When ON is set, the marker list is displayed on the split screen.
When OFF is set, the marker list overlaps the waveform screen.
This setting is commonly used for all channels.

7.6.5 Delta-Marker Function

The delta-marker function is used to find out the difference between the active marker and the specified marker. Three kinds of modes are available depending on the marker to be specified, as follows:

(1) ΔMKR mode

Obtains the difference between the child marker and the active marker by setting the child marker to the position of the active marker. The difference between the current position and the previous position (child marker) can be obtained by moving the active marker.

(2) ACT MKR mode

Obtains the difference between the active marker and the other marker.

(3) FIXED MKR mode

Obtains the difference between the active marker and the fixed marker by freely setting the fixed marker regardless of the trace data. The fixed marker is set with the stimulus and response values.
That is, the fixed marker is always fixed to the position of specified stimulus and response values regardless of the trace data.

The response values for the other markers including the child marker are on the trace data.

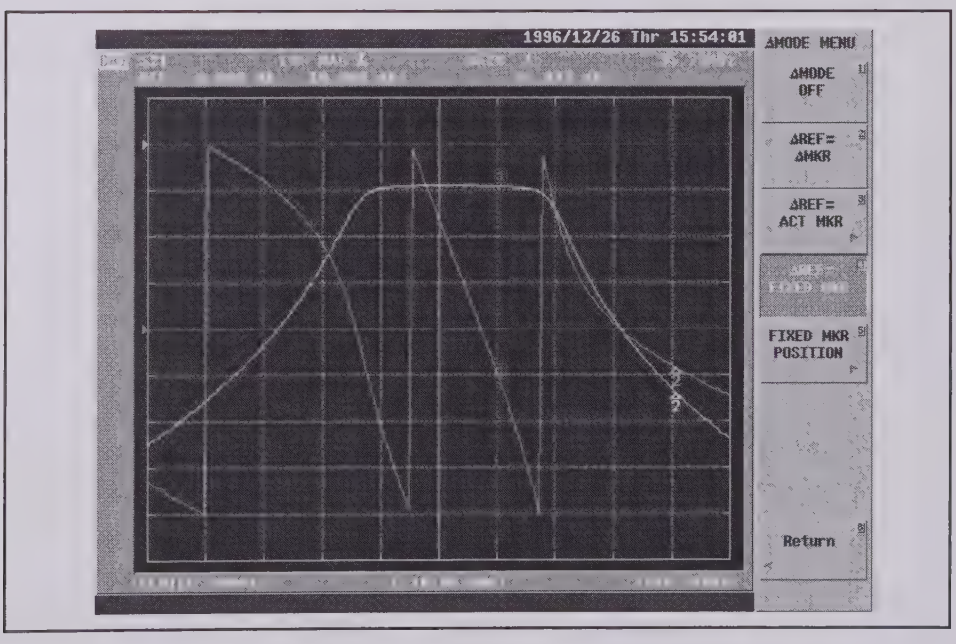


Figure 7-1 Delta-Marker Function

ΔREF=ΔMKR	:	The delta value of active marker ① and the child marker ③ is measured.
ΔREF=ACT MKR	:	The delta values of active marker ① and compare marker ② is measured.
ΔREF=FIXED MKR	:	The delta value of active marker ① and the Fixed marker ④ is measured.

The Setting and the Explanation

① Press the **[MKR]** to call the marker menu. (Refer to section A.4.)

② Press the *{Δ MODE MENU}* to call the delta-mode menu.

③ Delta mode menu

{Δ MODE OFF}	:	Sets OFF the delta mode.
{Δ REF=Δ MKR}	:	Selects the ΔMKR mode. (See step ④.)
{Δ REF= ACT MKR}	:	Selects the ACT MKR mode to call the ACT MKR menu. (See step ⑤.)
{Δ REF= FIXED MKR}	:	Selects the FIXED MKR mode.
{FIXED MKR POSITION}	:	Calls the FIXED MKR setting menu. (See step ⑥.)

④ For Δ MKR mode

Pressing the *{Δ REF=Δ MKR}* in step ③ causes the child marker (*) to be displayed on the active marker position and the result to be displayed at the active area on the screen.

Since the active marker setting can be changed, obtain the data by moving the active marker using the data knob.

⑤ For ACT MKR mode

Pressing the *{Δ REF=ACT MKR}* in step ③ calls the ACT MKR menu. Set the marker for comparison. Since the menu has also the software menu to change the active marker, it is possible to change the active marker without returning to the **[MKR]**.

- ACT MKR menu(1 of 2)

{COMPARE MARKER 1}	:	Changes the marker for comparison to the marker 1.
{COMPARE MARKER 2}	:	Changes the marker for comparison to the marker 2.
{COMPARE MARKER 3}	:	Changes the marker for comparison to the marker 3.
{COMPARE MARKER 4}	:	Changes the marker for comparison to the marker 4.
{COMPARE MARKER 5}	:	Changes the marker for comparison to the marker 5.
{ACTIVATE MARKER [ ]}	:	Calls the active marker menu. (Refer to sub-section 7.6.1.)

- ACT MKR menu (2 of 2)

  {COMPARE MARKER 6} : Changes the marker for comparison to the marker 6.

  {COMPARE MARKER 7} : Changes the marker for comparison to the marker 7.

  {COMPARE MARKER 8} : Changes the marker for comparison to the marker 8.

  {COMPARE MARKER 9} : Changes the marker for comparison to the marker 9.

  {COMPARE MARKER 10} : Changes the marker for comparison to the marker 10.

  {ACTIVATE MARKER [ ]} : Calls the active marker menu. (Refer to sub-section 7.6.1.)

⑥ For FIXED MKR mode

Pressing the *{ΔREF=FIXED MKR}* in step ③ displays the difference between the active MKR and the FIXED MKR (◇) on the active area of the screen.

To set the FIXED MKR position, press the *{FIXED MKR POSITION}* on the same menu to call the FIXED MKR setting menu.

- FIXED MKR setting menu

  {FIXED MKR STIMULUS}: Sets the FIXED MKR stimulus value.

  {FIXED MKR VALUE} : For the Smith chart and polar display, sets the FIXED MKR response value (real part).

  {FIXED MKR AUX VALUE}: For the Smith chart and polar display, sets the FIXED MKR response value (imaginary part).

  {FIXED MKR → ACTIVE MKR}:
  Sets the FIXED MKR to the active marker position.

  If changing the stimulus reference value or others cause the fixed marker to move outside the screen, the fixed marker is not displayed.
  The fixed marker can be displayed and set even if the delta mode is off.
  If a parameter other than "1/S" has been set to CONVERSION ON in the parameter conversion menu, the fixed marker can not be set nor displayed.

Note: ***FIXED MKR STIMULUS/VALUE/AUX VALUE can be set only with the ten-key.***

7.6.6 Marker Menu during Impedance Measurement

To read the impedance directly by the marker during parameter conversion or impedance measurement, the marker menu can be selected from three modes (parameter conversion, Smith chart display, or polar display).

The Setting and the Explanation

① Press the **[MKR]** to call the marker menu. (Refer to section A.4.)

② Press the *{MARKER MODE MENU}* to call the marker mode menu.

③ Marker mode menu

{CONVERSION MKR MENU [ ]}:
Calls the conversion marker menu which sets the marker data display mode during the parameter conversion. (See step ④.)

{SMITH MKR MENU [ ]} :
Calls the Smith marker menu which sets the marker data display mode during the Smith chart display. (See step ⑤.)

{POLAR MKR MENU [ ]} :
Calls the menu which sets the marker data display mode during the polar display. (See step ⑥.)

④ Conversion marker menu

{DEFAULT} : Displays the value corresponding to the data format.

{LIN MKR} : Displays the linear magnitude value and the phase value.
When a format is selected except SMITH and POLAR in the format menu, if SMOOTHING is set to ON, a correct value cannot be obtained.

{Re/Im MKR} : Displays the complex data.
When a format is selected except SMITH and POLAR in the format menu, if SMOOTHING is set to ON, a correct value cannot be obtained.

⑤ Smith marker menu

{LIN MKR} : Displays the linear magnitude value and the phase value.

{LOG MKR} : Displays the logarithmic magnitude value and the phase value.

{Re/Im MKR} : Displays the complex data.

{R+jX MKR} : Displays the complex impedance.

{G+jB MKR} : Displays the complex admittance.

{Z0 VALUE} : Sets the characteristic impedance.

⑥ Polar marker menu

{LIN MKR}	:	Displays the linear magnitude value and the phase value.
{LOG MKR}	:	Displays the logarithmic magnitude value and the phase value.
{Re/Im MKR}	:	Displays the complex data.
{Z0 VALUE}	:	Sets the characteristic impedance.

7.6.7 Marker Analysis Function

The marker analysis function has search functions for obtaining the values such as maximum value and minimum value.

This function also provide the functions to change the signal source setting and the display scale setting by the marker value.

The following items are provided for search functions:

- Maximum value
- Minimum value
- Phase : 0°
- Phase : ±180°
- Specified response value (magnitude, phase)
- Filter analysis (bandwidth, Q, shaping factor)

To perform the analysis operation, two modes are provided. Select any one of the mode for only one execution, or the mode for repeating every sweeping. The analysis area is selected the all measurement area, or the part search mode performing within the area specified by the marker delta mode.

CAUTION!
Searching is basically performed to the displayed data, but
- ***The case that phase 0° or phase ±180° was selected when the phase data was not displayed.***
- ***The SMITH/POLAR case***

In the above cases, the displayed data is not searched but the internal data.

The Setting and the Explanation

① Press the **[MKR→]** to call the marker search menu. (Refer to section A.4.)

② Marker search menu
(This menu is used to change the signal source or the display scale.)

{MARKER→START} : Changes the sweep-start value of the signal source to the active marker position.

{MARKER→STOP} : Changes the sweep-stop value of the signal source to the active marker position.

{MARKER→CENTER} : Changes the sweep-center value of the signal source to the active marker position.

{ΔMARKER→SPAN} : Changes the span of the signal source to the area specified by the ΔMARKER.

{MARKER→REF.VALUE} : Changes the reference value of the display scale to the response value of the active marker.

{PART SRCH [ ]} : Calls the part search menu. (See step ⑦.)

{MKR SEARCH[ ]} : Calls the search menu. (See step ③.)

③ Search menu

{MKR SEARCH OFF} : The search function is released.

{MAX} : Moves the active marker to the position of maximum value. If the FORMAT is SMITH/POLAR, the active marker moves to the maximum value position of the internal LOGMAG data.

{MIN} : Moves the active marker to the position of minimum value. If the FORMAT is SMITH/POLAR, the active marker moves to the minimum value position of the internal LOGMAG data.

{TARGET} : Calls the target menu which searches the specified value. (See step ④.)

{RIPPLE} : Calls the ripple menu which searches the ripple. (See step ⑤.)

{FLTR ANA} : Calls the filter analysis menu. (See step ⑥.)

{TRACKING ON/OFF} : Selects the function for searching every sweep.
OFF: Searches one time.
ON: Searches every sweep. When ON is selected, the search is performed on the search menu, and the search is repeated/executed every sweep.

CAUTION!
If MAX search and MIN search is performed when FORMAT is SMITH/POLAR, the searched position may not be the same as the display when SMOOTHING is ON. Because the SMOOTHING is performed to the display data but not to the internal LOGMAG data.

④ Target menu

{TARGET VALUE} : Searches the specified value (response value).
If SMITH or POLAR is set in the format menu, LOG MAG type of data is searched as TARGET VALUE.
However, if SMOOTHING is set to ON, the active marker does not move to a correct data.

{ 0° } : Searches the phase 0°.
The phase data is surely searched without regard to any format.
If SMOOTHING is set to ON, the active marker does not move to a correct data.

{±180°} : Searches the phase 180°.
The phase data is surely searched without regard to any format.
If SMOOTHING is set to ON, the active marker does not move to a correct data.

{LEFT SEARCH} : Searches specified value of left side from current marker position.

{RIGHT SEARCH} : Searches specified value of right side from current marker position.

CAUTION!

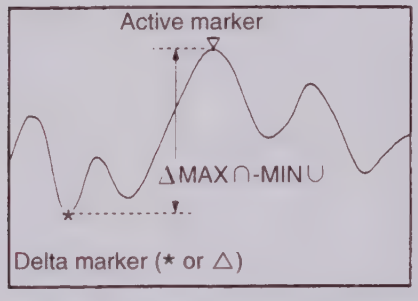
1. ***When the internal data is searched, the searched position may not be the same as the display because the smoothing is performed to the internal data when SMOOTHING is ON.***
2. ***TARGET VALUE can be specified only with the ten-key.***

⑤ Ripple menu

{MAX ∩} : Searches for the maximum of local maximum peak values.
When FORMAT is SMITH/POLAR, the internal LOGMAG data is searched.

{MIN ∪} : Searches for the minimum of local minimum peak values.
When FORMAT is SMITH/POLAR, the internal LOGMAG data is searched.

{ΔMAX∩-MIN∪} : Calculates the difference between the maximum of local maximum peak values and the minimum of local minimum peak values.
Moves the active marker to the position of the maximum of local maximum peak values and moves the delta marker (other than FIXED MKR) to the position of the minimum of local minimum peak values.
When FORMAT is SMITH/POLAR, the internal LOGMAG data is searched.

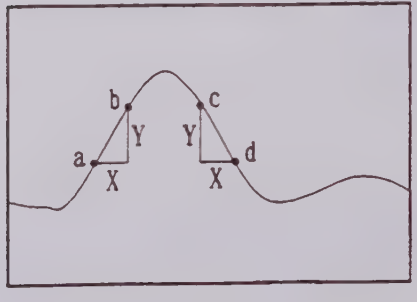


{MAX - MIN} : Searches for the difference between the maximum and the minimum.

{ΔX} : Specifies the detecting sensitivity for the ripple search.
The differential coefficient ΔX is specified here.
Specify a ratio, regarding the full scale of the horizontal axis as 100%.
ΔX is specified only with the ten-key.

{ΔY} : Specifies the detecting sensitivity for the ripple search.
The differential coefficient ΔY is specified here.
ΔY are specified only with the ten-key.

How to obtain ripple (local maximum peak value)
To obtain ripple value under the detecting sensitivity ΔY/ΔX, search for a point (a) where the gradient (Y/X) of the trace is larger than ΔY/ΔX.
Next, search a point (d) where the reverse gradient (Y/X) of the trace is larger than ΔY/ΔX. Then the maximum value between (a) and (d) is obtained as a local maximum peak value.
A local minimum peak value can be obtained by reversing the polarity of ΔY/ΔX in the above procedure.



CAUTION!

1. ***When the internal data is searched, the searched position may not be the same as the display because the smoothing is performed to the internal data when SMOOTHING is ON.***
2. ***ΔX and ΔY setting are possible only with ten keys.***

⑥ Filter analysis menu

{WIDTH VALUE} : Specifies the maximum loss when determining the pass band. Specifies the loss (X dB) from the level reference point.

{FILTER TYPE BAND/NOTC} : Selects the filter type.
BAND : Analyzes a band pass filter.
NOTC : Analyzes a notch filter.

{SEARCH FROM [ ]} : To the search reference menu.

{DISPLAY MODE ABS/REL} : Selects the way in which the bandwidth is displayed.
ABS : Displays the bandwidth using two absolute values (i.e., the lower and higher frequencies).
REL : Displays the bandwidth relative to the center frequency.

{SEARCH IN/OUT} : Selects the direction to be searched on the stimulus axis.
IN : Searches outward from the search reference point.
OUT : Searches inward to the reference point.

{FILTER ANAL ON/OFF} : Turns the measurement and its result display ON or OFF. When ON, this function starts the measurement and displays the result.
C. F : Displays the center frequency of the bandwidth specified by the loss (X dB) from the level reference point.
L.F : In ABS mode, this displays the left frequency of the bandwidth (the low frequency pointed by the ↓ marker).
In REL mode, this displays the difference between the left frequency of the bandwidth and the center frequency.
R.F : In ABS mode, this displays the right frequency of the bandwidth (the high frequency pointed by the ↑ marker).
In REL mode, this displays the difference between the right frequency of the bandwidth and the center frequency.
BW : Bandwidth
Q : Q factor
SF : Shaping factor

Note: ***When the format type is set except LOG MAG, MAG&PHASE/LOG, and MAG&DELAY, if SMOOTHING is set to ON, a correct data cannot be searched.***

⑦ Search reference menu

Selects the reference point when analyzing filters (Note 1).

{ACTIVE MARKER} : Makes the active marker the level reference point.

{MAXIMUM VALUE} : Makes the minimum loss point the level reference point.

{REFERENCE LINE} : Makes the reference line the level reference point (Note 2).

Note 1: Each search reference (which is composed of the stimulus axis and the level axis) specified by the search reference menu is as follows:

	MAX reference		Active marker reference		Reference line reference	
	Stimulus axis	Level axis	Stimulus axis	Level axis	Stimulus axis	Level axis
Band pass filter analysis	MAX	MAX	Active Mkr	Active Mkr	MAX	Ref Line
Notch filter analysis	MIN	MAX	MIN	Active Mkr	MIN	Ref Line

MAX : Minimum loss point/MIN : Maximum loss point/Active Mkr : Active marker/ Ref Line : Reference line

For example, when MAX reference has been selected for a band pass filter analysis, the search reference point on the stimulus axis is the MAX (the minimum loss point); the search reference point on the level axis is the MAX (the minimum loss point).

Note 2: The Reference Line reference can be selected only when the FORMAT is specified as LOG MAG, LOG MAG&PHASE or LOG MAG&DELAY.

<Examples of the result of filter analysis>
Q factor is calculated from a bandwidth B.W' where data is 3dB off a minimum loss value of the measured data, and the center frequency C.F' in the bandwidth B.W'.

$$Q = \frac{C.F'}{B.W'}$$

Shaping factor is calculated from a bandwidth B.W' where data is 3dB off minimum loss value of the measured data, and a bandwidth B.W'' where data is 60dB off the minimum loss value.

$$S.F = \frac{B.W''}{B.W'}$$

The stimulus and level reference points used to calculate the Q and Shaping factors are unaffected regardless of the level reference points which are set by the *{SEARCH FROM [ ]}* key.

	Stimulus reference	Level reference
Band pass filter analysis	MAX	MAX
Notch filter analysis	MIN	MAX

Analysis methods for each setting are described as follows:

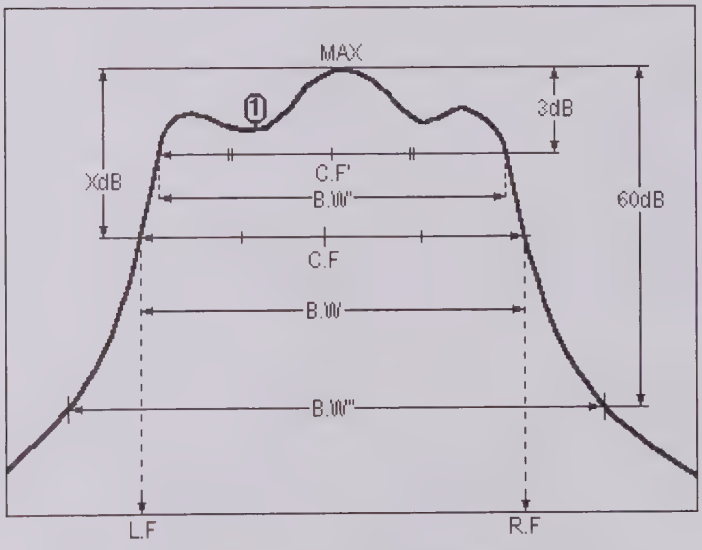


Figure 7-2 Band Pass Filter Analysis/MAX Reference

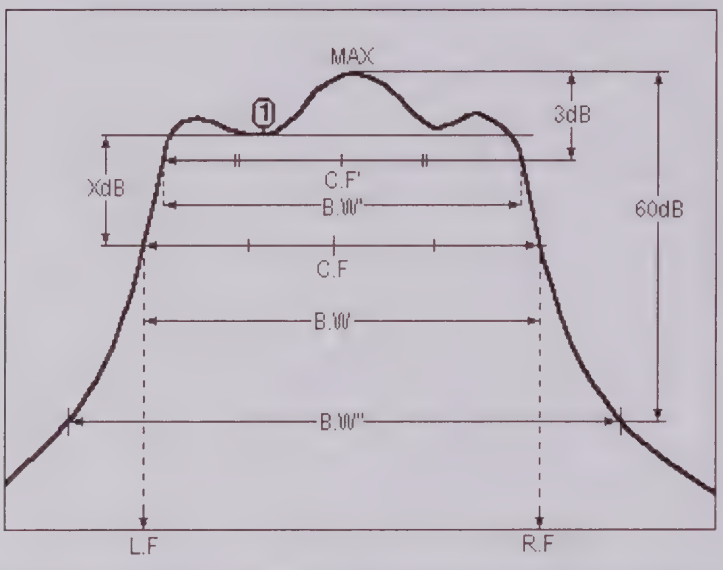


Figure 7-3 Band Pass Filter Analysis/Active Marker Reference

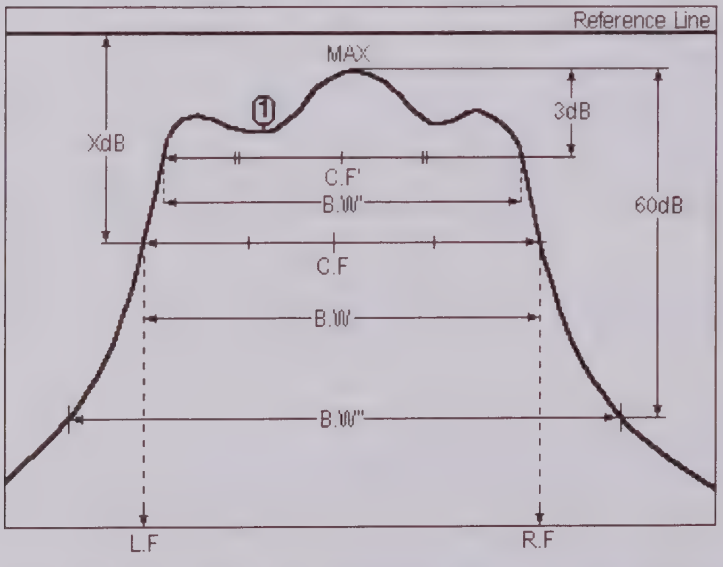


Figure 7-4 Band Pass Filter Analysis/Reference Line Reference

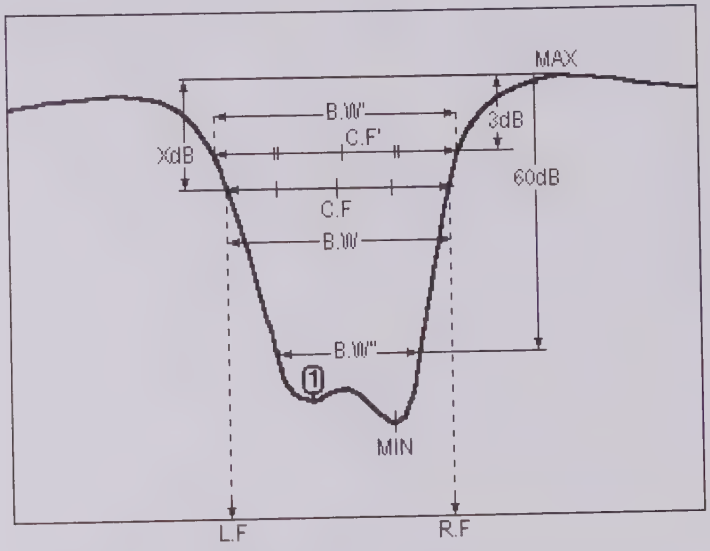


Figure 7-5 Notch Filter Analysis/MAX Reference

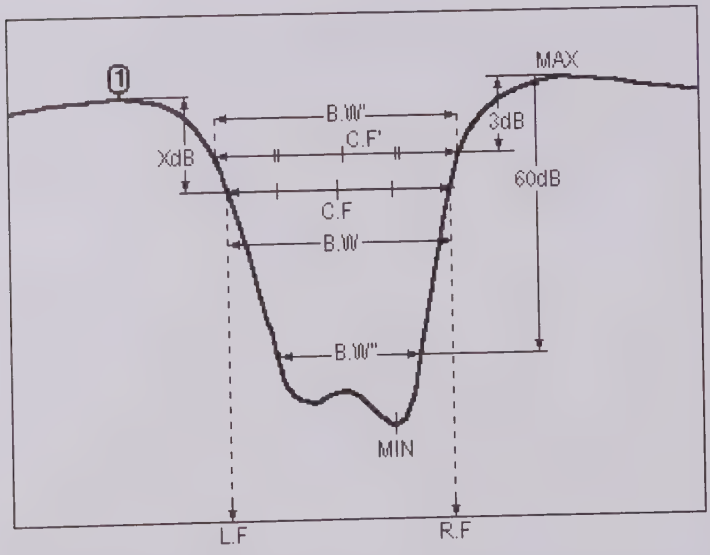


Figure 7-6 Notch Filter Analysis/Active Marker Reference

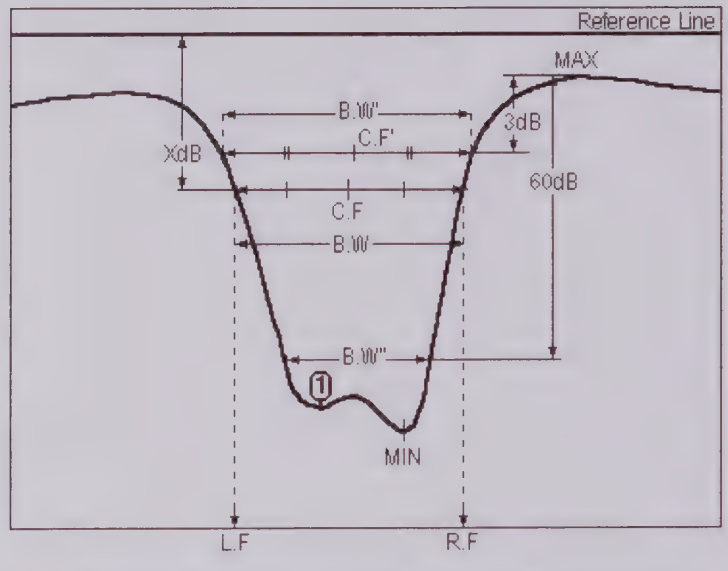


Figure 7-7 Notch Filter Analysis/Reference Line Reference

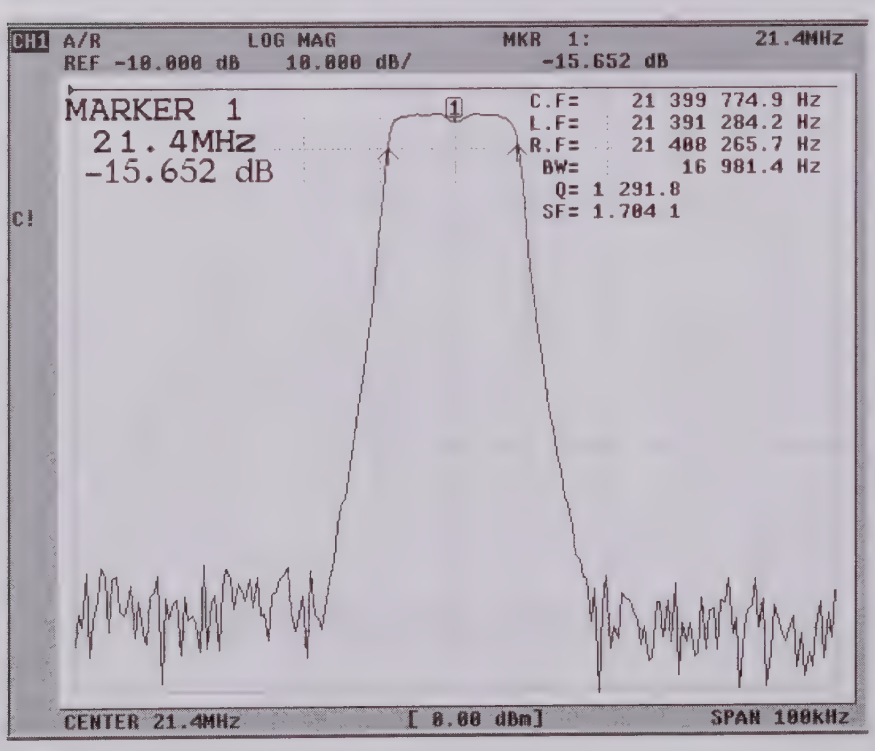


Figure 7-8 Example of Filter Analysis Execution

⑧ Part search menu

This menu is used to search specified area instead of the whole measurement area for the analysis to obtain the maximum value, minimum value and so on.

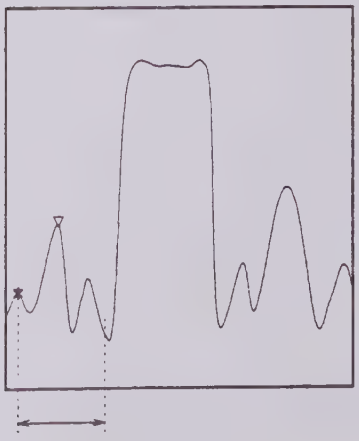
{Δ MODE MENU} : Calls the Δ marker mode menu. (See step ②.)

{SET RANGE} : Sets partially search range which was set at Δ marker mode.

{STATISTICS ON/OFF} : Sets the statistical analysis function.
The statistical analysis function calculates the average, standard deviation and peak to peak for the range specified by the part search (for the entire measurement range when the part search is turned OFF). The measurement result will be displayed on the right of the measurement screen.

{PART SRCH ON/OFF} : Selects ON/OFF of the part search.
ON ; Part search
OFF ; All search

<Measurement example by MAX search>



A range specified with Δmaker.

At OFF :
Searches a maximum response value within measurement frequency.

At ON :
Set a range specified with Δ marker as a partial search range with SET RANGE. Then set PART SRCH to ON and a marker begins to search the maximum value in the set range.

7.7 Time Domain Function(OPT 70)

(The Time domain function is optional. This function is not available if this option has not been installed.)

7.7.1 Time Domain Transformation Function

A measurement result in the frequency domain can be transformed into the corresponding response in the time domain by using the Time domain transformation function. The result in the time domain will be represented as an impulse response or step response of the DUT.

The relationship between a frequency domain response and the corresponding time domain response of this analyzer is defined by the Fourier transformation.

The time domain result can be obtained by calculating a frequency domain measurement result with the inverse Fourier transformation.

(1) Transformation Mode

The bandpass and low pass modes are available for transforming the frequency domain data into time domain data.
The bandpass mode is a general purpose mode which allows the user to set the frequency range freely. This mode is used to measure a DUT impulse response with its limited bands.

Using the low pass mode, the user can obtain information about points of discontinuity. In the low pass mode, the impulse mode and the step mode are available. The former is used to obtain the response by an impulse input to a DUT ; and the latter, to obtain the response by a step input to DUT.
In the low pass mode, however, frequency range settings are restricted. Frequency data must be spaced equally in the range from the virtual DC point to the stop frequency:

(Start frequency) x (number of measuring points) = (stop frequency)

It is necessary that the above relation must be maintained.
The user can easily set frequency ranges to meet the condition above using *{SET FREQ LOW PASS}* function.

(2) Distance display mode

The horizontal axis is set to a time axis (sec) immediately after the time domain transformation function is turned ON. This time axis can be transformed into a distance axis (m). At this time, however, only the annotations (values and units) on the horizontal axis are transformed and the waveform data on the vertical axis remains unchanged.

When the distance display mode is set, the horizontal axis is transformed from time to distance using the following formula.

$$L = c \times V_f \times T$$

Where,

L := Distance(m)

c := Velocity of light $\cong 3 \times 10^8$

V_f := Velocity factor (Note)

T := Time(s)

When the reflection from the cable is measured, the actual physical distance is half of the measured distance because the measured distance is equivalent to a round-trip path where the signal goes and returns. For this reason, values of time and distance are cut in half and displayed as the *{REFLECTION TIME}* and *{REFLECTION DISTANCE}* measurements.

Note: ***Set the velocity factor using {VELOCITY FACTOR}.***
The velocity factor of Teflon and polyethylene dielectric is approximately 0.07 and 0.66, respectively.

(3) Magnification of the time axis domain

The time span Tspan in the time axis domain is determined by the frequency span Fspan and the number of measurement points N.

$$T_{span} = \frac{N\text{-}1}{F_{span}}$$

The waveform in the time domain can be magnified by changing the time range settings ([START], [STOP], and [SPAN]). [START] and [STOP] can freely be set within the range of -Tspan to Tspan. (Note)

The magnification rate z automatically changes starting from the set time range. The time span T'span that is actually displayed is represented by the following expression.

$$T'_{span} = \frac{N\text{-}1}{F_{span} \times Z}$$

Note: ***If the time span exceeds Tspan, the displayed data includes redundant information.***

Operating procedure:

① Press ***[FUNCTION]*** to call the function menu.

Press *{TRANSFORM}* to call the time domain transformation menu.

Note: When OPT70 is not installed, [TRANSFORM] will not be displayed.

② Time domain transformation menu

Each channel can be set individually.

{TRANSFORM ON/OFF} : Toggles the time domain display ON or OFF.

ON: Displays the time domain.

OFF: Displays the frequency domain.

{TRANSFORM MODE [ ]} : Calls the time domain mode menu.

{TRANSFORM STIMULUS [ ]}:
Calls the time domain stimulus menu.
It is possible to toggle whether or not the distance is displayed.

{WINDOW [ ]} : Calls the window menu to select a window (see section 7.7.2).

{GATE [ ]} : Calls the gate menu to select a gate (see section 7.7.3).

7.7.2 Window Processing

Leakage phenomenon in Fourier transformation occurs due to data discontinuity in the frequency domain, or data truncation in the start and stop frequencies. This leakage phenomenon consequently causes the ripples called ringing. Window processing is required to reduce this, so that the window is applied to the frequency domain data to reduce ripples in the time domain.

Three types of windows are available: *{MAXIMUM}* provides the maximum effect to reduce the ringing, but the rise time (impulse width) is longer. On the other hand, *{MINIMUM}* does not suppress the ringing, but sharp rising characteristics can be obtained.

Operating procedure:

① Press ***[FUNCTION]*** to call the function menu.

Press *{TRANSFORM}* to call the time domain transformation menu.
Press *{WINDOW [ ]}* to call the window menu.

Note: When OPT70 is not installed, [TRANSFORM] will not be displayed.

② Window menu

Each channel can be set individually.

{MAXIMUM} : Specifies the 4-term Blackman-Harris type. The maximum reduction can be obtained.

{NORMAL} : Specifies the 2-term Hamming type.

{MINIMUM} : Specifies the rectangular type. Window processing is not performed.

7.7.3 Gate Function

The necessary components can be extracted from a result of the time domain response using this function. Peculiar frequency components can be either extracted or removed using a type of filter in the time domain response.

The results can be seen in both the frequency and time domains.

When the gate span is positive, the specified range is extracted; when negative, the specified range is removed.

There are four types of gate functions: for *{MAXIMUM}*, the attenuation at the cutoff region can be obtained to the maximum and the ripple at the pass region can be minimized. The cutoff time characteristics are degraded however.

For *{MINIMUM}*, very sharp cutoff characteristics can be obtained, but the attenuation at the cut-off region is reduced.

Operating procedure:

① Press *{FUNCTION}* to call the function menu.

Press *{TRANSFORM}* to call the time domain transformation menu.
Press *{GATE [ ]}* to call the gate menu.

Note: When OPT70 is not installed, [TRANSFORM] will not be displayed.

② Gate menu

Each channel can be set individually.

{GATE ON/OFF}	:	Toggles the gate function ON or OFF. This cannot be used at the same time as the CDMA IF gate function.
{GATE START}	:	Sets the gate start time.
{GATE STOP}	:	Sets the gate stop time.
{GATE CENTER}	:	Sets the gate center time.
{GATE SPAN}	:	Sets the gate's time span.
{GATE SHAPE [ ]}	:	Calls the gate shape menu to set a type of gates (see ③).

③ Gate shape menu

Each channel can be set individually.

{MAXIMUM}	:	Specifies the 4-term Blackman-Harris type. The maximum attenuation can be obtained in the cutoff region.
{WIDE}	:	Specifies the 3-term Blackman-Harris type.
{NORMAL}	:	Specifies the 2-term Hamming type.
{MINIMUM}	:	Specifies the rectangular type.

7.7.4 Time Domain Transformation Mode

Sets the transformation mode to the time domain.

Procedure

① Press **[FUNCTION]** to call the function menu.
Press *{TRANSFORM}* to call the time domain transformation menu.
Press *{TRANSFORM MODE}* to call the time domain transformation mode menu.

② The time domain transformation mode menu
The mode is independently set for each channel.

{SET FREQ LOW PASS}	:	Sets a frequency range which conforms to the low pass mode restrictions.
{LOW PASS IMPULSE}	:	Selects the low pass impulse transformation mode.
{LOW PASS STEP}	:	Selects the low pass step transformation mode.
{BANDPASS}	:	Selects the bandpass transformation mode.

7.7.5 Transformation of the Time Domain Horizontal Axis

Sets the annotation of the horizontal axis to a time or distance display.

Procedure

① Press **[FUNCTION]** to call the function menu.
Press *{TRANSFORM}* to call the time domain transformation menu.
Press *{TRANSFORM STIMULUS}* to call the time domain stimulus menu.

② The time domain stimulus menu
The mode is independently set for each channel.

{TIME}	:	Sets the annotation of the horizontal axis to time (sec).
{DISTANCE}	:	Sets the annotation of the horizontal axis to distance (m).
{REFLECTION TIME}	:	Sets the annotation of the horizontal axis to time (sec) and displays half of the *{TIME}* value when measuring the reflection time.
{REFLECTION DISTANCE}	:	Sets the annotation of the horizontal axis to distance (m) and displays half of the *{DISTANCE}* value.
{VELOCITY FACTOR}	:	Sets the velocity factor.

7.8 CDMA IF Filter Analysis Function

This function is suitable for measuring the characteristics of CDMA IF filter.

(1) Gate function of the CDMA IF filter

Obtains the frequency characteristics specifying the defined range of the filter delay time.

(2) Magnitude analysis function of the CDMA IF filter

The items to be analyzed are as follows:

- Center frequency: The center frequency between the two frequencies from which each magnitude is attenuated by the specified value from the peak value.
- Pass bandwidth: The frequency band between the two frequencies from which each magnitude is attenuated by the specified value from the peak value.
- Insertion loss: The peak value
- Ripple within the pass band: The difference between the peak and lowest local minimum values.
- Guaranteed attenuation: Lower value between the left and right values obtained by calculating the difference between the insertion loss and the value whose frequency is obtained either by adding the specified frequency to the center frequency (right side) or by subtracting the specified frequency from the center frequency (left side).

(3) Phase analysis function of the CDMA IF filter

Calculates the phase linearity of the IF filter.

Operation procedure:

① Press the *{FUNCTION}* to call the function menu.

Press the *{CDMA IF FILTER}* to call the CDMA IF filter analysis menu.

② CDMA IF filter analysis menu

Each channel can be set individually.

{CDMA IF GATE [ ]} : Calls the CDMA IF filter analysis menu (see ③).

{CDMA FILTER ANALYSIS [ ]} : Calls the CDMA IF filter magnitude analysis menu (see ⑤).

{CDMA PHASE LINEARITY [ ]} : Turns the CDMA phase linearity analysis ON or OFF. This function calculates phase linearity in compliance with the standards of the CDMA IF filter. The CDMA phase linearity analysis cannot be performed at the same time as the phase linearity analysis.

{PHASE LINEARITY [ ]} : Calls the Phase linearity analysis menu (see ⑥).

③ CDMA IF filter gate menu

Each channel can be set individually.

{CDMA IF GATE ON/OFF}: Toggles the CDMA IF filter gate function ON or OFF. The CDMA IF GATE cannot be ON together with the gate function of the time domain transformation function.

{CDMA GATE START [ ]}: Sets the start time of the CDMA IF filter gate.

{CDMA GATE STOP [ ]} : Sets the stop time of the CDMA IF filter gate.

{GATE SHAPE [ ]} : Calls the CDMA IF filter gate shape menu (see ④).

④ CDMA IF filter gate shape menu

Each channel can be set individually.

{MAXIMUM} : Specifies the 4-term Blackman-Harris type. The maximum attenuation can be obtained.

{WIDE} : Specifies the 3-term Blackman-Harris type.

{NORMAL} : Specifies the 2-term Hamming type.

{MINIMUM} : Specifies the rectangular type.

{CDMA IF} : Specifies a type which is optimized for the CDMA IF filter.

⑤ CDMA IF filter magnitude menu

{CDMA FILTER ANALYSIS [ ]}: Turns the magnitude analysis function ON or OFF. When this function is turned ON, the following analysis results are displayed:

Note: ***This function cannot be used with the filter analysis of marker analysis function or the statistical analysis function.***

C. F : Displays the center frequency between the pass bandwidth specified by the loss from the peak value.

B. W : Displays the pass bandwidth.

I. L : Displays the insertion loss (the peak value).

RPL : The difference between the peak and lowest local minimum values.

ATTN1 : Displays the guaranteed attenuation. The range calculated by comparing the points where the addition to and the subtraction from the CF of ATTN FREQ1 intersects the trace. These points are then used to calculate range between them and the I.L. The shorter of these two ranges is designated as ATTN1.

ATTN2 : Displays the guaranteed attenuation. The range calculated by comparing the points where the addition to and the subtraction from the CF of ATTN FREQ2 intersects the trace. These points are then used to calculate range between them and the I.L. The shorter of these two ranges is designated as ATTN2.

P. L : When the phase analysis function (CDMA IF filter analysis) is ON, the phase linearity is calculated and the result is displayed.

{WIDTH VALUE} : Specifies the bandwidth to be searched using the loss (X dB) from the peak value.

{ATTN FREQ1} : Specifies the first frequency for the guaranteed attenuation measurement. The guaranteed attenuation is not measured when this frequency is set to 0 (zero) (as the guaranteed attenuation

measurement is set to OFF).

{ATTN FREQ2} : Specifies the second frequency for the guaranteed attenuation measurement. The guaranteed attenuation is not measured when this frequency is set to 0 (zero) (as the guaranteed attenuation measurement is set to OFF).

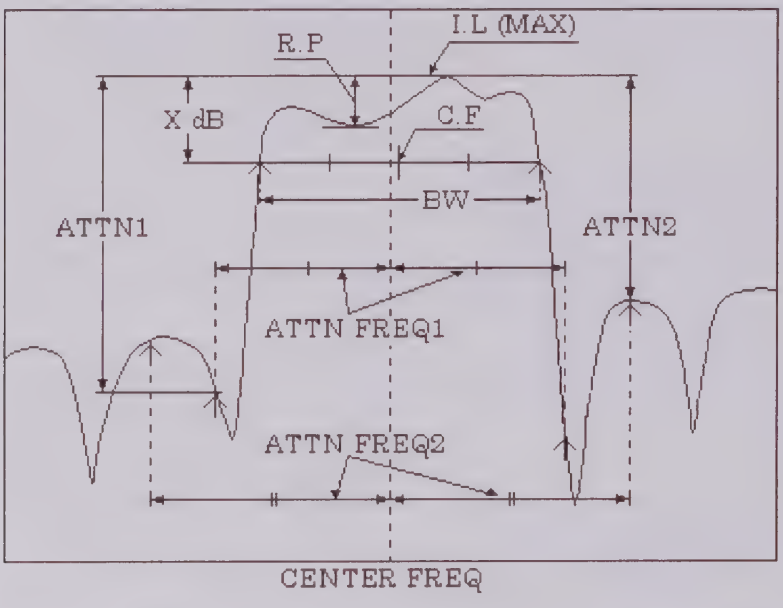
⑥ Phase linearity analysis menu

{PHASE LINEARITY ON/OFF}: Turns the Phase linearity analysis ON or OFF.

Note: ***The phase linearity analysis cannot be performed at the same time as the CDMA phase linearity analysis.***

{PARTIAL ON/OFF} : Turns the partial definition analysis ON or OFF. When this function is set to ON, the phase linearity is analyzed for the section specified by the *{SET RANGE}* (which is in the partial menu under the marker search menu). When set to OFF, the phase linearity is analyzed for the full measurement range.

<Example of CDMA IF Filter Analysis>



An example of CDMA IF Filter Analysis is shown above. The C.F, B.W, I.L and RPL are obtained using the loss (X dB) specified by *{WIDTH VALUE}*. When one of these has been calculated, the pass band is displayed with the ↑ marker.
In addition, the ATTN1 and 2 values are obtained as follows: After setting the C.F the user sets the ATTN FREQ1. The analyzer then subtracts the ATTN FREQ1 from the CF and calculates the point where this range intersects the trace. It then calculates the point where the addition of the ATTN FREQ1 to the CF intersects the trace, then calculates the range from these points to the I.L. Finally, these two points are compared, and the shorter one is designated as ATTN1. ATTN2 is calculated in the same way and both are indicated by ↑ markers on the display.

7.9 Sweep

The following five types are provided for sweeping the signal source.

- Linear frequency sweep : The frequency sweep between measurement points is performed in equal steps linearly.
- Log (logarithmic) frequency sweep
  : The frequency sweep between measurement points is performed in logarithmic step.
- User frequency sweep : By the user frequency sweep, measurement points are divided into maximum 30 segments, and frequency range is set to each segment.
  For example, if the segments are set in the stop band, pass band, twofold pass band of a band pass filter, then high data throughput can be obtained because of no sweeping in unnecessary area.
- Program sweep : By the program sweep is used to perform in every segment by dividing the measurement points into maximum 30 segments. Other than frequency, the output level, receiver section resolution bandwidth, and settling time can be set in every segment. The optimum sweep condition can be set, including throughput and dynamic range.
- Power sweep : The power sweep is used for level characteristic measurement.

7.9.1 Setting Sweep Type

The Setting and the Explanation

① Press the **[MENU]** to call the signal source menu. (Refer to section A.4.)

② Press the *{SWEEP TYPE [ ]}* to call the sweep type menu.

③ Sweep type menu

{LIN FREQ}	: Sets to the linear frequency sweep.
{LOG FREQ}	: Sets to the log (logarithmic) frequency sweep.
{USER SWEEP}	: Sets to the user frequency sweep.
{PROGRAM SWEEP}	: Sets to the program sweep.
{POW SWEEP}	: Sets to the power sweep.
{EDIT USER SWEEP}	: Calls the segment editing menu of the user frequency sweep. (Refer to sub-section 7.9.2.)
{EDIT PROG SWEEP}	: Calls the segment editing menu of the program sweep. (Refer to sub-section 7.9.3.)

Setting sweep area

- Sweep area settings for the linear frequency sweep log frequency sweep are performed with **[START]**, **[STOP]** or **[CENTER]**, **[SPAN]**.
- Power sweep are performed with **[START]**, **[STOP]**.
- For the user frequency sweep and program sweep, set the sweep area on each segment editing menu.

CAUTION!
If USER FREQUENCY SWEEP or PROGRAM SWEEP is set, input segments are detected and arranged internally in increasing order of frequency.
If STOP frequency of a segment is higher than START frequency of the next segment in the arranged segments, an error occurs.

7.9.2 Editing Segment of User Frequency Sweep

The Setting and the Explanation

① Press the **[MENU]** to call the signal source menu. (Refer to section A.4.)

② Press the *{SWEEP TYPE [ ]}* to call the sweep type menu.

③ Press the *{EDIT USER SWEEP}* to call the user frequency sweep segment editing menu.

④ User frequency sweep segment editing menu

{SEGMENT: NUMBER}	:	Specifies the segment number in the range of 0 to 29.
{START}	:	Sets the start frequency of the specified segment.
{STOP}	:	Sets the stop frequency of the specified segment.
{FREQ}	:	Sets the frequency of the specified point when the number of points of the specified segment is set to 1. Reversely, if this frequency is set, then the number of points automatically becomes 1.
{POINT}	:	Sets the number of points of the specified segment.
{CLEAR SEG}	:	Clears the specified segment.
{CLEAR ALL SEG}	:	Clears all segments.

CAUTION!

1. ***If the same segment number is edited on the segment editing menu of the program sweep, then the user frequency segment is also changed. (Segment holds the program sweep in common.)***
2. ***The total number of points of each segment by user frequency sweep cannot exceed 1201 points. (The maximum number of measurement points is 1201 points.)***

7.9.3 Editing Segment of Program Sweep

The Setting and the Explanation

① Press the **[MENU]** to call the signal source menu. (Refer to section A.4.)

② Press the *{SWEEP TYPE[ ]}* to call the sweep type menu.

③ Press the *{EDIT PROG SWEEP}* to call the program sweep segment editing menu.

④ Program sweep segment editing menu

- Program sweep segment editing menu (1 of 2)

  {SEGMENT: NUMBER} : Specifies the segment number in the range of 0 to 29.
  {START} : Sets the start frequency of the specified segment.
  {STOP} : Sets the stop frequency of the specified segment.
  {POINT} : Sets the point number of the specified segment.
  {CLEAR SEG} : Clears the specified segment.
  {CLEAR ALL SEG} : Clears all segments.

- Program sweep segment editing menu (2 of 2)

  {SEGMENT: POWER} : Sets the output level of the specified segment.
  {IF RBW} : Sets the receiver section resolution bandwidth of the specified segment.
  {SETTLING TIME} : Sets the settling time of the specified segment.

CAUTION!

1. ***If the same segment number is edited on the segment editing menu of the program sweep, then the user frequency segment is also changed. (Segment holds the program sweep in common.)***
2. ***The total number of points of each segment by program sweep cannot exceed 1201 points. (The maximum number of measurement points is 1201 points.)***

<Example of program sweep execution>

Here is an example how the program sweep is applied to the trace on the screen.

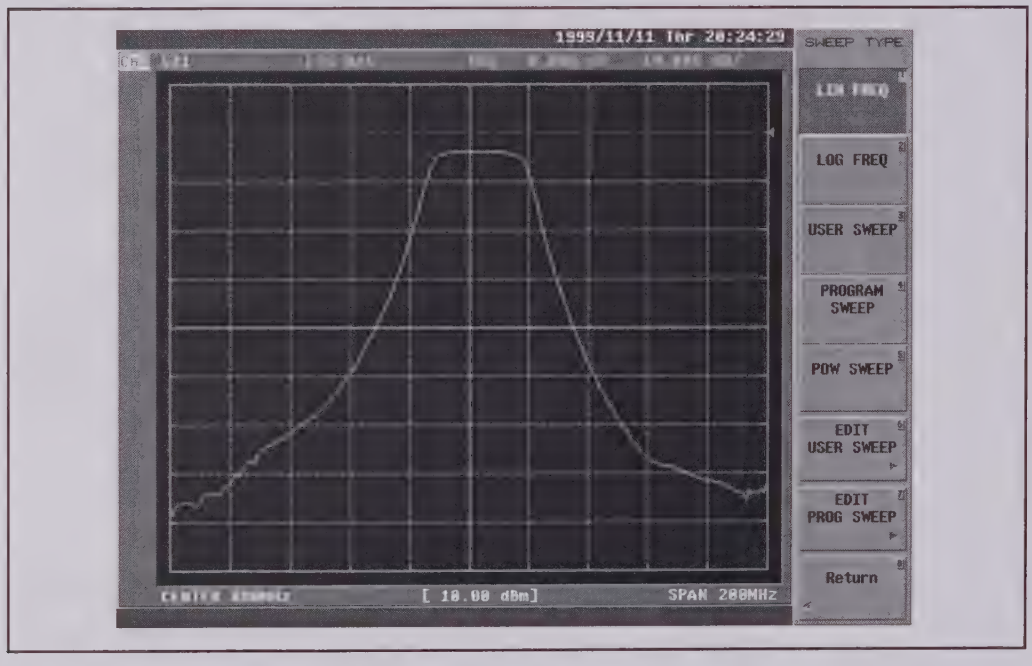


Figure 7-9 The Screen before the Segment Edited

SEG.	START	STOP	POWER	IF RBW	POINT
0	80MHz	860MHz	10.0dBm	1kHz	50
1	860MHz	900MHz	5.0dBm	10kHz	50
2	900MHz	1680MHz	10.0dBm	10kHz	50

Each segment is edited as shown like the above-mentioned.

The result of execution is shown in the following.

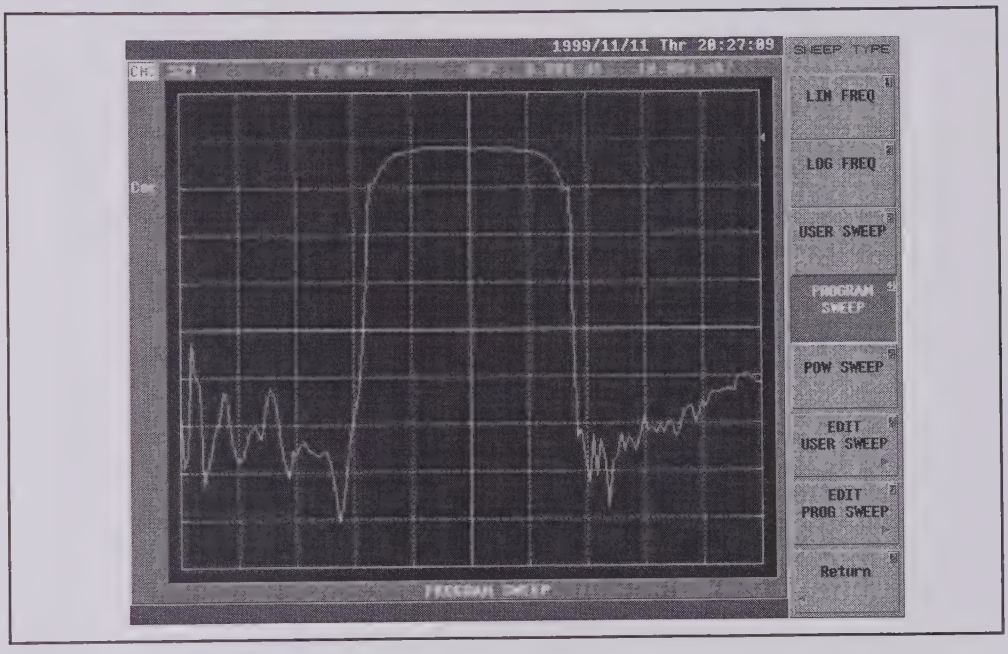


Figure 7-10 The Screen after the Segment Edited

7.10 Software Fixture Function (OPT 71/72)

7.10.1 Overview

OPT 71 and OPT 72 allow you to analyze the characteristics of a device under test (DUT) measured with an instrument impedance of 50É¹ by converting them into an arbitrary impedance using the impedance function. In addition, assuming that an arbitrary matching circuit is attached, the characteristics of a DUT can be measured using the matching circuit function. Furthermore, the characteristics of a DUT itself can be measured by eliminating the effect of the measurement jig using the network elimination function. In combination with OPT 11(built-in 3-port test set) or OPT 14 (built-in 4-port test set), they can easily be analyzed as balanced parts and floating parts (for example 2-port unbalanced parts). Note that only OPT 71 has a measurement function for balanced or floating parts.

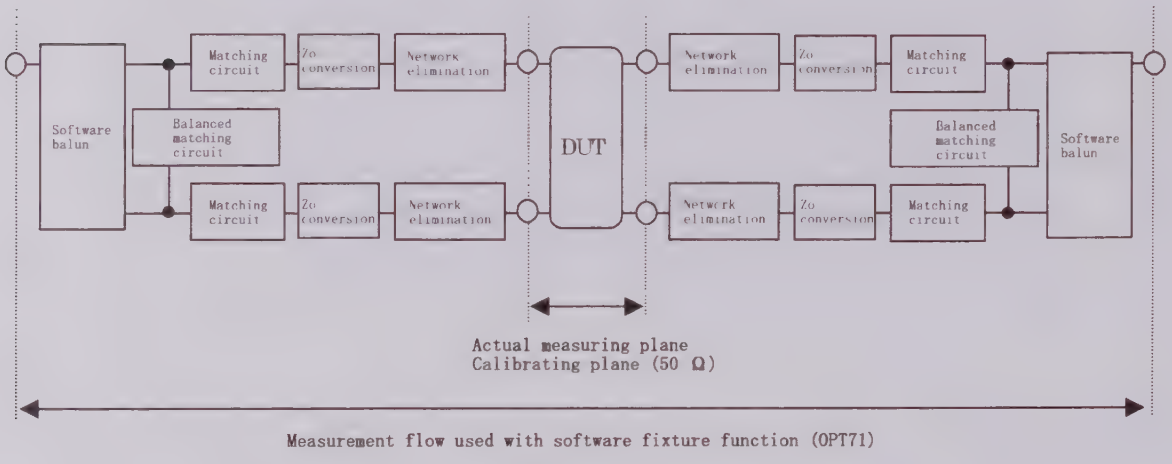


Figure 7-11 Measurement Flow Used with OPT 71

7.10.2 Function

7.10.2.1 Network Elimination Function

The network elimination function allows you to accurately measure DUT characteristics by eliminating a complete 2-port network, including the phase, magnitude and impedance for each port and extending a calibration plane.

When the characteristics of the measurement jig have been obtained in advance, this function allows you to measure the characteristics of a DUT with the jig characteristics eliminated using this function.

The port extension and network elimination functions can be used at the same time (see Figure 7-12).

The network to be eliminated is set using the S-parameter file (user defined circuit file) in T.S file format (Touchstone file).

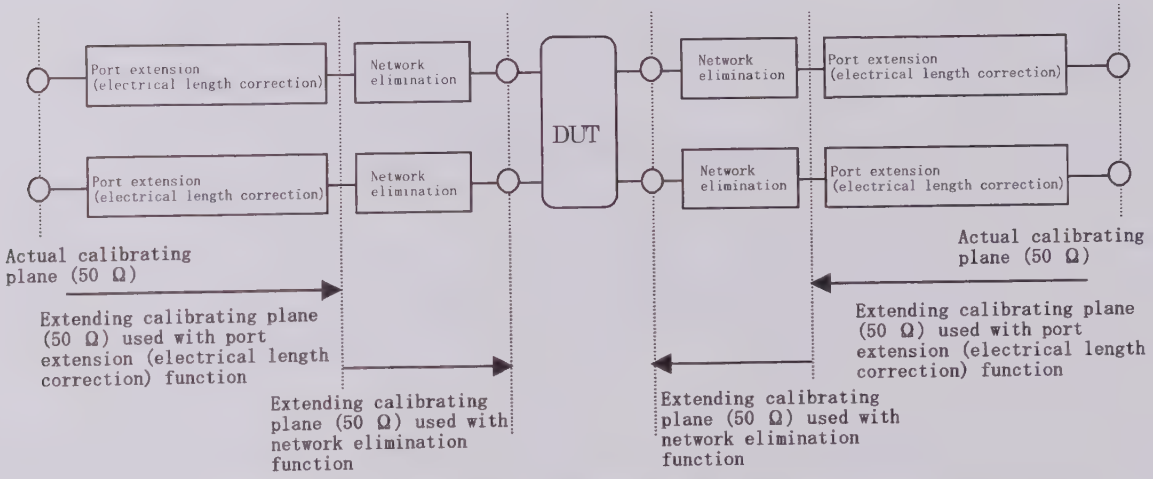

Port extension (electrical length correction)
Network elimination
DUT
Network elimination
Port extension (electrical length correction)
Port extension (electrical length correction)
Network elimination
Network elimination
Port extension (electrical length correction)
Actual calibrating plane (50 Ω)
Extending calibrating plane (50 Ω) used with port extension (electrical length correction) function
Extending calibrating plane (50 Ω) used with network elimination function
Actual calibrating plane (50 Ω)
Extending calibrating plane (50 Ω) used with port extension (electrical length correction) function
Extending calibrating plane (50 Ω) used with network elimination function

Figure 7-12 Measurement Flow Used with Network Elimination Function

7.10.2.2 Impedance Conversion Function

Measures impedance converted into an arbitrary normalized impedance (a real number value) for each port.

- Dynamic range when changing the impedance

  When measuring devices with impedance other than 50 Ω using the impedance conversion function, the dynamic range is attenuated if compared with measurements of 50 Ω devices. The following graph shows the attenuation ratio.
  Use the graph as a guide to obtain the maximum dynamic range during measurement.

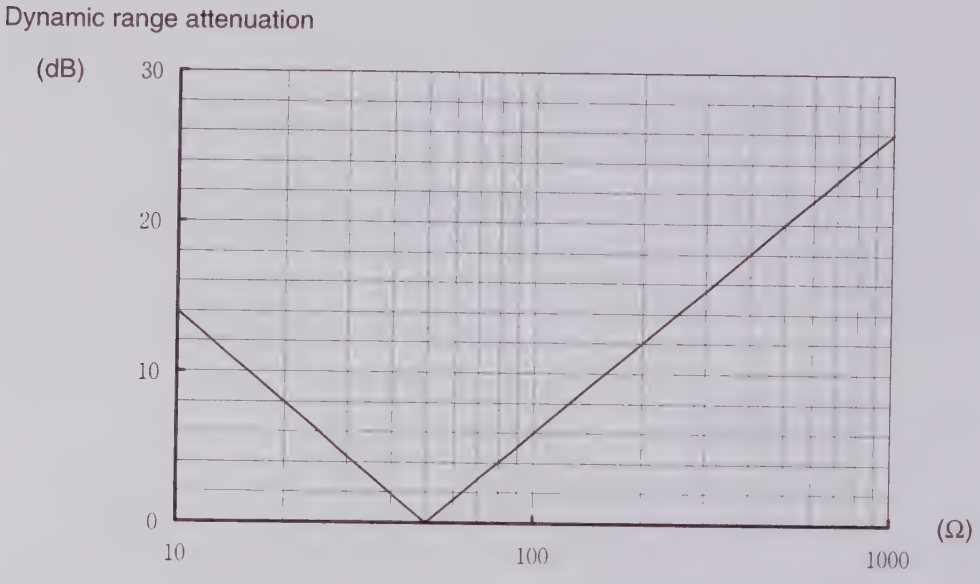


Figure 7-13 Dynamic Range When Changing the Impedance

- S-parameter and characteristic impedance

  The impedance conversion function allows you to set the characteristic impedance used to describe the S-parameter to an arbitrary value.
  Where the voltage is V_i, the current is I_i and the impedance is Z_i for the port i, the incident wave a_i and the reflected wave b_i are obtained using the following expressions.

$$a_i = \frac{1}{2}\left(\frac{V_i}{\sqrt{Z_i}} + I_i\sqrt{Z_i}\right) \qquad b_i = \frac{1}{2}\left(\frac{V_i}{\sqrt{Z_i}} - I_i\sqrt{Z_i}\right)$$

  The S-parameter S_{ij} for an n-port device is defined by the following expression using the incident wave a_i and reflected wave b_i.

$$\begin{pmatrix} b_1 \\ b_2 \\ \vdots \\ b_n \end{pmatrix} = \begin{pmatrix} S_{11} & S_{12} & \cdots & S_{1n} \\ S_{21} & S_{22} & \cdots & S_{2n} \\ \vdots & \vdots & & \vdots \\ S_{n1} & S_{n2} & \cdots & S_{nn} \end{pmatrix} \begin{pmatrix} a_1 \\ a_2 \\ \vdots \\ a_n \end{pmatrix}$$

- Calculating each parameter individually

  As shown above, the S-parameter is defined as an element of a matrix. However, each parameter can be obtained using a simple circuit calculation.
  As an example of a 2-port device, the calculation method where the PORT 1 impedance is Z_1 and PORT 2 impedance is Z_2 is given below.

(1) Reflection parameter S_{11}

Where the device impedance seen from the input side (PORT 1) is Z_{DUT} when the device output side (PORT 2) is terminated with impedance Z_2, S_{11} can be calculated using the following expression.

$$S_{11} = \frac{Z_{DUT} - Z_1}{Z_{DUT} + Z_1}$$

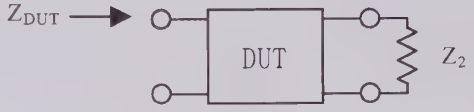


Figure 7-14 Reflection Parameter

(2) Transmission parameter S_{21}

Where the signal source with Z_1 impedance and the load (receiving section) with Z_2 impedance exists, S_{21} can be calculated using the following expression according to the conditions shown below.

- V_{THRU} appears across the load if the signal source is directly connected to the load.
- V_{TRANS} appears across the load when a transformer of $\sqrt{Z_1}:\sqrt{Z_2}$ is inserted between the signal source and the load.
- V_{DUT} appears across the load when a DUT is inserted between the signal source and the load.

$$S_{21} = \frac{V_{DUT}}{V_{TRANS}}$$

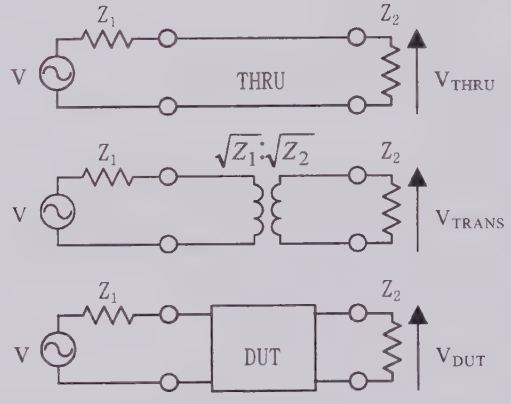


Figure 7-15 Transmission Parameter

In particular where $Z_1=Z_2$, $Z_{TRANS}=Z_{THRU}$, and $S_{21} = \frac{V_{DUT}}{V_{TRAN}} = \frac{V_{DUT}}{V_{THRU}}$.

On the contrary where $Z_1 \neq Z_2$, $Z_{TRANS} \neq Z_{THRU}$, and $S_{21} = \frac{V_{DUT}}{V_{TRANS}} \neq \frac{V_{DUT}}{V_{THRU}}$.

(Reference)
A transformer with a turn ratio of n_1 to n_2 has the voltages and currents shown in Figure 7-16 Transformer. The S parameters are as shown below when a transformer of $\sqrt{Z_1}:\sqrt{Z_2}$ is normalized to Z_1 and Z_2:
$S_{11} = S_{22} = 0$, and $S_{21} = S_{12} = 1$.

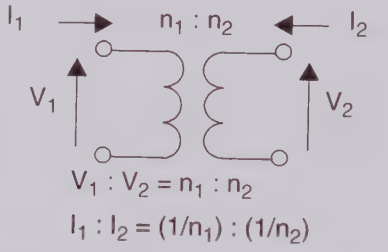


Figure 7-16 Transformer

7.10.2.3 Matching Circuit Function

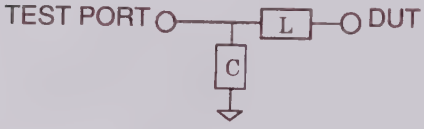
The matching circuit function is used to measure the characteristics of a DUT, assuming that an arbitrary matching circuit is attached to the measurement port.

There are two setting methods for the matching circuit as shown below.

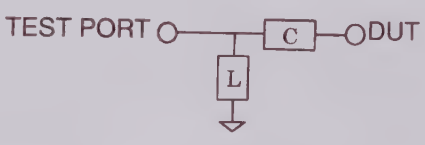
(1) Setting using the combination of a capacitor and an inductor

Arbitrary values can be set to capacitance C and inductance L.
In addition, the conductance component G of a capacitor and the resistance component R of an inductor can be set.
There are five matching circuit models as a setting with C and L.

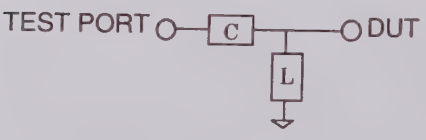
- parallel C-series L (C(P)-L(S)-D)



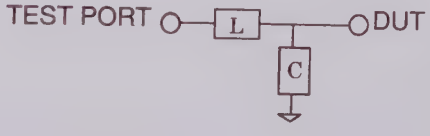
- parallel L-series C (L(P)-C(S)-D)



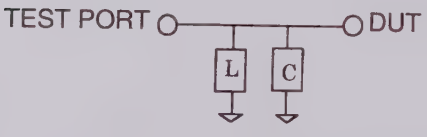
- series C-parallel L (C(S)-L(P)-D)



- series L-parallel C (L(S)-C(P)-D)



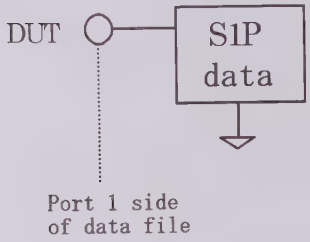
- parallel L-parallel C (L(P)-C(P)-D)



(2) Setting using the S-parameter file

The matching circuit can be set using an arbitrary S-parameter file (user defined circuit file) created by a circuit simulator. The matching circuit is set in T.S file (Touchstone file) format. There are two matching circuit models for setting methods using the S-parameter file.

- 1-port matching circuit (S1P data file)

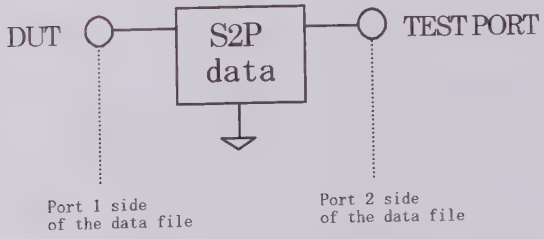


The file name of a matching circuit to be attached is fixed for each measurement port as shown below.

TEST PORT1	sfadd1.s1p
TEST PORT2	sfadd2.s1p
TEST PORT3	sfadd3.s1p
TEST PORT4	sfadd4.s1p

Note: Using a SIP data file means that the port is terminated with the reflection coefficient.

- 2-port matching circuit (S2P data file)



The file name of a matching circuit to be attached is fixed for each measurement port as shown below.

TEST PORT1	sfadd1.s2p
TEST PORT2	sfadd2.s2p
TEST PORT3	sfadd3.s2p
TEST PORT4	sfadd4.s2p

7.10.2.4 Balanced Matching Circuit Function (OPT 71 only)

The balanced matching circuit function is used to measure the characteristics of a DUT, assuming that the matching circuit of capacitance C and inductance L is attached between the measurement ports. Arbitrary values can be set to capacitance C and inductance L. The conductance component G of the capacitor and resistance component R of the inductor can also be set.

The matching circuit function adds a matching circuit between the measurement port and GND, while the balanced matching circuit function adds a matching circuit between the measurement ports.

Note: ***The balanced matching circuit function is not available for OPT 72.***

- When measuring a 3-port device (OPT 11 or 14 is required)

  The balanced matching circuit can be added between TEST PORT 2 and TEST PORT 3.

- When measuring a 4-port device (OPT 14 is required)

  The balanced matching circuits can be added between TEST PORT 2 and TEST PORT 3, and TEST PORT 3 and TEST PORT 4 respectively.

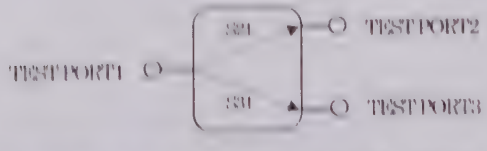
7.10.2.5 Degree of Balance Measurement Function (OPT 71 only)

The degree of balance measurement function is used to measure the balanced factors (B parameter) of the magnitude and phase of transmission characteristics. When they are completely balanced, the measurement results show 0 dB for the magnitude and 0 degree for the phase.

The definition of the degree of balance is as follows.

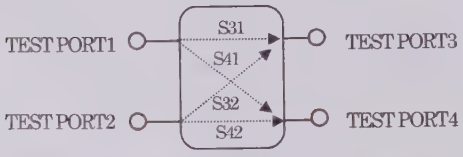
Note: ***The balanced matching circuit function is not available for OPT 72.***

- When measuring a 3-port device (OPT 11 or 14 is required)



Degree of balance between TEST PORT 2 and TEST PORT 3: B23 = -(S21/S31)
Degree of balance between TEST PORT 3 and TEST PORT 2: B32 = -(S31/S21)

- When measuring a 4-port device (OPT 14 is required)



Degree of balance between TEST PORT 3 and TEST PORT 4: B34 = -(S31-S32)/(S41-S42)
Degree of balance between TEST PORT 4 and TEST PORT 3: B43 = -(S41-S42)/(S31-S32)
Degree of balance between TEST PORT 1 and TEST PORT 2: B12 = -(S13-S14)/(S23-S24)
Degree of balance between TEST PORT 2 and TEST PORT 1: B21 = -(S23-S24)/(S13-S14)

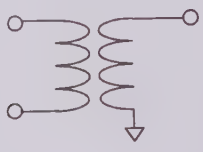
7.10.2.6 Software Balun Function (OPT 71 only)]

The software balun function connects an ideal balun between the measurement ports to convert a balanced device into a 2-port unbalanced device and measures the characteristics of the converted 2-port unbalanced device.

The ideal balun can be selected from two types, a floating balun and a differential balun.

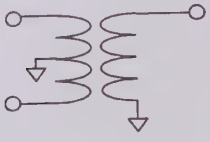
Note: ***The software balun function is not available for OPT 72.***

① Floating balun



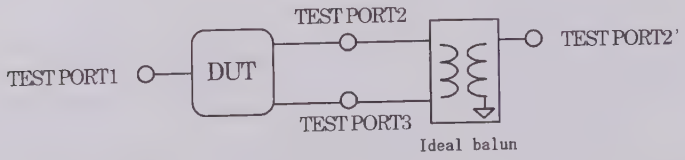
This is an ideal transformer of floating type isolated from GND.
This type of balun is used to evaluate the floating device unaffected by the common impedance between the measurement port and GND.

② Differential balun



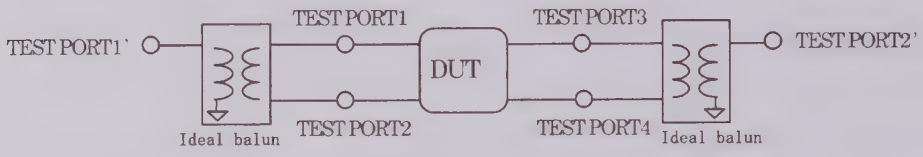
This is an ideal transformer of differential type with the neutral point grounded.
This type of balun is used to evaluate the device whose measurement port is balanced to GND.

- When measuring a 3-port device (OPT 11 or 14 is required)



An ideal balun is connected between TEST PORT 2 and TEST PORT 3 and these ports are converted into the balanced port TEST PORT2'.
The DUT is measured as a 2-port network of TEST PORT1 to TEST PORT 2' and S-parameters are displayed as SS11, SS21, SS12 and SS22.

- When measuring a 4-port device (OPT 14 is required)



An ideal balun is connected between TEST PORT 1 and TEST PORT 2 and these ports are converted into the balanced port TEST PORT 1'.
An ideal balun is connected between TEST PORT 3 and TEST PORT 4 and these ports are converted into the balanced port TEST PORT 2'.
The DUT is measured as a 2-port network of TEST PORT 1' to TEST PORT 2' and S-parameters are displayed as SS11, SS21, SS12 and SS22.

7.10.2.7 Mode Analysis Function (OPT 71 only)

The mode analysis function is used to measure the balanced device for each common mode and differential mode components. The common mode component is a signal component generated between the neutral point of the balanced port and GND. The differential mode component is a signal component generated between the balanced ports.

Note: The mode analysis function is not available for OPT 72.

There are four kinds of mode analysis as shown below.

- Differential mode input and differential mode output: S-parameters are displayed as Sdd11, Sdd21, Sdd12 and Sdd22.
- Differential mode input and common mode output: S-parameters are displayed as Scd11, Scd21, Scd12 and Scd22.
- Common Mode input and differential mode output: S-parameters are displayed as Sdc11, Sdc21, Sdc12 and Sdc22.
- Common Mode input and common mode output: S-parameters are displayed as Scc11, Scc21, Scc12 and Scc22.

As for the subscripts of the S-parameter, an alphabet shows the mode and a number shows the measurement port. Both alphabet and number subscripts are displayed in the order of output and input in the same way as a generally used S-parameter.

Alphabet subscript	d:	Differential mode
	c:	Common mode
Number subscript	1:	Shows TEST PORT 1 for a 3-port device and the balanced PORT 1 consisting of TEST PORT 1 and TEST PORT 2 for a 4-port device.
	2:	Shows the balanced PORT 3 consisting of TEST PORT 2 and TEST PORT 3 for a 3-port device and the balanced PORT 2 consisting of TEST PORT 3 and TEST PORT 4 for a 4-port device.

Example:

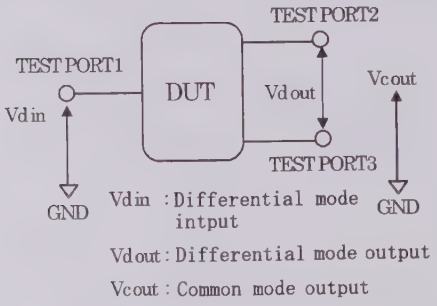
Sdc21 indicates the transmission characteristics of the DUT with the common mode input to PORT 1 and differential mode output from PORT 2.

Sdc22 indicates the reflection characteristics of the DUT with the differential mode input to PORT 2 and common mode output from PORT 2.

- When measuring a 3-port device (OPT 11 or 14 is required)

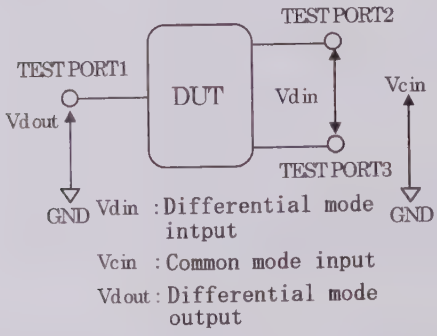
  Since TEST PORT 1 is an unbalanced port, there is no distinction between common mode and differential mode. However, TEST PORT 1 is measured as differential mode.

  ① When the device is in forward direction (TEST PORT 1 is input and TEST PORT 2 and TEST PORT 3 are output)



Differential mode→differential mode
Input reflection characteristics: Sdd11
Differential mode→differential mode
Forward direction transmission characteristics: Sdd21
Differential mode→common mode
Forward direction transmission characteristics: Scd21

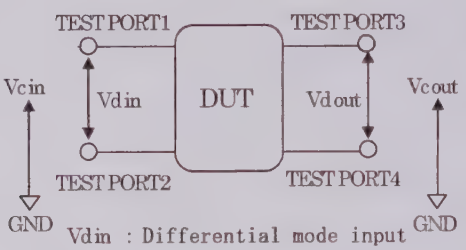
  ② When the device is in reverse direction (TEST PORT 1 is output and TEST PORT 2 and TEST PORT 3 are input)



Differential mode→differential mode
Output reflection characteristics: Sdd22
Differential mode→common mode
Output reflection characteristics: Scd22
Common mode→common mode
Output reflection characteristics: Scc22
Common mode→differential Mode
Output reflection characteristics: Sdc22
Differential mode→differential mode
Reverse direction transmission characteristics: Sdd12
Common mode→differential mode
Reverse direction transmission characteristics: Sdc12

- When measuring a 4-port device (OPT 14 is required)

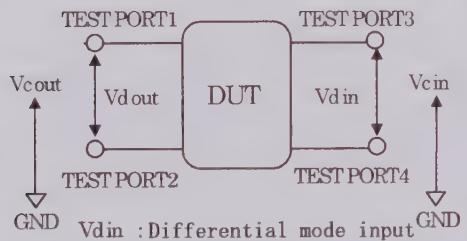
  ① When the device is in forward direction (TEST PORT 1 and TEST PORT 2 are input, and TEST PORT 3 and TEST PORT 4 are output)



Vdin : Differential mode input
Vcin : Common mode input
Vdout : Differential mode output
Vcout : Common mode output

Differential mode→differential mode
Input reflection characteristics: Sdd11
Differential mode→common mode
Input reflection characteristics: Scd11
Common mode→common mode
Input reflection characteristics: Scc11
Common mode→differential Mode
Input reflection characteristics: Sdc11
Differential mode→differential mode
Forward direction transmission characteristics: Sdd21
Differential mode→common mode
Forward direction transmission characteristics: Scd21
Common mode→common mode
Forward direction transmission characteristics: Scc21
Common mode→differential mode
Forward direction transmission characteristics: Sdc21

② When the device is in reverse direction (TEST PORT 1 and TEST PORT 2 are output, and TEST PORT 3 and TEST PORT 4 are input)



Vdin : Differential mode input
Vcin : Common mode input
Vdout : Differential mode output
Vcout : Common mode output

Differential mode→differential mode
Output reflection characteristics: Sdd22
Differential mode→common mode
Output reflection characteristics: Scd22
Common mode→common mode
Output reflection characteristics: Scc22
Common mode→differential mode
Output reflection characteristics: Sdc22
Differential mode→differential mode
Reverse direction transmission characteristics: Sdd12
Common mode→differential mode
Reverse direction transmission characteristics: Sdc12

7.10.2.8 Saving Results

Measurement data being analyzed can be saved to floppy disks in three different ways.

(1) T.S file (Touchstone file)

All S-parameters of n by n for the n-port device under analysis are saved in Touchstone file format. The extension of a file is ".snp" (n is the number of ports).The data format of S-parameter can be selected from magnitude (dB)/phase (deg) format and real part/imaginary part format.
Saved data is arranged in the sequence shown below for each measurement frequency (when the format is magnitude (dB)/phase (deg).
In the header of the file, "impedance 50 É¹" is described.

- When measuring a 1-port device

  Frequency S11 (dB) S11 (deg)

- When measuring a 2-port device

  Frequency S11 (dB) S11 (deg) S21 (dB) S21 (deg) S12 (dB) S12 (deg) S22 (dB) S22 (deg)

- When measuring a 3-port device

  Frequency S11 (dB) S11 (deg) S12 (dB) S12 (deg) S13 (dB) S13 (deg) ! Line feed
  S21 (dB) S21 (deg) S22 (dB) S22 (deg) S23 (dB) S23 (deg) ! Line feed
  S31 (dB) S31 (deg) S32 (dB) S32 (deg) S33 (dB) S33 (deg) ! Line feed

- When measuring a 4-port device

  Frequency S11 (dB) S11 (deg) S12 (dB) S12 (deg) S13 (dB) S13 (deg) S14 (dB) S14 (deg) ! Line feed
  S21 (dB) S21 (deg) S22 (dB) S22 (deg) S23 (dB) S23 (deg) S24 (dB) S24 (deg) ! Line feed
  S31 (dB) S31 (deg) S32 (dB) S32 (deg) S33 (dB) S33 (deg) S34 (dB) S34 (deg) ! Line feed
  S41 (dB) S41 (deg) S42 (dB) S42 (deg) S43 (dB) S43 (deg) S44 (dB) S44 (deg) ! Line feed

(2) CSV file

All S-parameters of n by n for the n-port device under analysis are saved in CSV file format. The extension of a file is ".csv". The data format of S-parameter can be selected from magnitude (dB)/phase (deg) format and real part/imaginary part format.
Saved data is arranged in the sequence shown below for each measurement frequency (when the format is magnitude (dB)/phase (deg).

- When measuring a 1-port device

  Frequency S11 (dB) S11 (deg)

- When measuring a 2-port device

  Frequency S11 (dB) S11 (deg) S21 (dB) S21 (deg) S12 (dB) S12 (deg) S22 (dB) S22 (deg)

- When measuring a 3-port device

  Frequency S11 (dB) S11 (deg) S12 (dB) S12 (deg) S13 (dB) S13 (deg) ! No line feed
  S21 (dB) S21 (deg) S22 (dB) S22 (deg) S23 (dB) S23 (deg) ! No line feed
  S31 (dB) S31 (deg) S32 (dB) S32 (deg) S33 (dB) S33 (deg) ! No line feed

- When measuring a 4-port device

```
Frequency S11 (dB) S11 (deg) S12 (dB) S12 (deg) S13 (dB) S13 (deg) S14 (dB) S14 (deg)! No line feed
S21 (dB) S21 (deg) S22 (dB) S22 (deg) S23 (dB) S23 (deg) S24 (dB) S24 (deg)      !No line feed
S31 (dB) S31 (deg) S32 (dB) S32 (deg) S33 (dB) S33 (deg) S34 (dB) S34 (deg)      !No line feed
S41 (dB) S41 (deg) S42 (dB) S42 (deg) S43 (dB) S43 (deg) S44 (dB) S44 (deg)      !No line feed
```

In the measurements of a 3-port or 4-port device, a line feed is executed in the T.S file, but all items of measurement data are written in one line in the CSV file.

(3) CSV DISP file

Data being displayed on the active channel is saved in CSV file format. The extension of the file is ".csv." Although all measured S-parameters are saved in the T.S file or CSV file, only data displayed on the active channel is saved in the CSV DISP file in the same format as the displayed data. When the active channel is displayed in the 2-trace mode, the first trace data is saved.
The saved data is arranged in the sequence of measurement frequency and S-parameter data.

7.10.2.9 Operation Procedure

Use the following procedure to call the software fixture menu.

[FUNCTION] → *{SOFTWARE FIXTURE}*

① Software fixture menu

{SOFTWARE FIXTURE ON/OFF}:
Selects ON/OFF of all software fixture functions.

{PORT CONDITION}: Displays the port condition menu (see ②).

{BALANCE MEASUREMENT}:
Displays the balance measurement menu (see ⑧). Sets the balanced matching circuit function, degree of balance measurement function and software balun function to analyze the balanced device.

{MODE ANALYSIS ON/OFF}:
Selects ON/OFF of the mode analysis function. When the mode analysis function is set to ON, the MEAS menu is changed (see ⑮).

{FIXTURE LIST ON/OFF}: Selects ON/OFF of the software fixture function setting list display. When the list of settings is set to ON, the screen display is switched from the measurement data to the software fixture setting list.

{LOAD USE CIRCUIT}: Displays the user defined circuit menu (see ⑩). Reads the user defined circuit file used in the network elimination function and matching circuit function from the floppy disk.

{SAVE FILE}: Displays the data saving menu (see ⑭). Saves the measurement results on the floppy disk.

{Return}: Returns to the FUNCTION menu.

Note: ***The software fixture function is valid only when full calibration is being executed. When an attempt is made to set the software fixture function to ON while full calibration is not executed, a message "Calibration data not found" is displayed and the function is not set to ON.***

② Port condition menu

{PORT EXTENSION [ ]}: Displays the port extension menu (see ③).

{DELETE CIRCUIT}: Displays the network elimination menu (see ④).

{NORMALIZED IMPEDANCE [ ]}:
Calls the impedance conversion menu (see ⑤).

{ADD CIRCUIT}: Displays the matching circuit menu (see ⑥).

{Return}: Returns to the software fixture menu.

③ Port extension menu

{EXTENSION ON/OFF}: Selects ON/OFF from the port extension function.

{EXTENSION PORT 1}: Sets the port extension value for TEST PORT 1.

{EXTENSION PORT 2}: Sets the port extension value for TEST PORT 2.

{EXTENSION PORT 3}: Sets the port extension value for TEST PORT 3.

{EXTENSION PORT 4}: Sets the port extension value for TEST PORT 4.

{MARKER→EXTENSION}: Sets the measured value by the active marker as a port extension value in the reflection wave measurement.
TEST PORT 1 is set when measuring S11.
TEST PORT 2 is set when measuring S22.
TEST PORT 3 is set when measuring S33.
TEST PORT 4 is set when measuring S44.

Note: ***Calculates a port extension value assuming the port is in the open state (reflection coefficient = 1). The half of the measured value (delay) is the port extension value.***
The port extension function is ignored during the transmission characteristic measurement.

{Return}: Returns to the port condition menu.

④ Network elimination menu

{PORT1 DEL CIRCUIT ON/OFF}:
Selects ON/OFF of the network elimination function for TEST PORT 1.

{PORT2 DEL CIRCUIT ON/OFF}:
Selects ON/OFF of the network elimination function for TEST PORT 2.

{PORT3 DEL CIRCUIT ON/OFF}:
Selects ON/OFF of the network elimination function for

TEST PORT 3.

{PORT4 DEL CIRCUIT ON/OFF}:

Selects ON/OFF of the network elimination function for TEST PORT 4.

{LOAD DEL S2P}: Displays the network elimination file menu (see ⑬). Reads the user defined circuit file from the floppy disk.

{Return}: Returns to the port condition menu.

Note: ***Even when the network elimination function is set to ON for each port, the function does not operate while the software fixture function is set to OFF.***

⑤ Impedance conversion menu

{IMPEDANCE TRANSFORM ON/OFF}:

Selects ON/OFF of the impedance conversion function.

{PORT1 IMPEDANCE}: Sets the impedance of TEST PORT 1.

{PORT2 IMPEDANCE}: Sets the impedance of TEST PORT 2.

{PORT3 IMPEDANCE}: Sets the impedance of TEST PORT 3

{PORT4 IMPEDANCE}: Sets the impedance of TEST PORT 4.

{Return}: Returns to the port condition menu.

Note: ***Even when the impedance conversion function is set to ON, the function does not operate while the software fixture function is set to OFF.***

⑥ Matching circuit menu

- 1 of 4 page

{PORT1 ADD CIRCUIT ON/OFF}:

Selects ON/OFF of the matching circuit function for TEST PORT 1.

{PORT1 ADD TYPE [ ]}: Displays the matching circuit type menu (see ⑦). Sets the matching circuit type of TEST PORT 1.

{PORT1 CAP C}: Sets the capacitance C of TEST PORT 1. When "0" is entered, the capacitance is assumed to be not connected and ignored.

{PORT1 CAP G}: Sets the conductance G for the capacitance of TEST PORT 1.

{PORT1 IND L}: Sets the inductance L of TEST PORT 1. When "0" is entered, the inductance is assumed to be not connected and ignored.

{PORT1 IND R}: Set the resistance R for the inductance of TEST PORT 1.

{Return}: Returns to the port condition menu.

{More 1/4}: Moves to the 2 of 4 page.

- 2 of 4 page

{PORT2 ADD CIRCUIT ON/OFF}:
Selects ON/OFF of the matching circuit function for TEST PORT 2.

{PORT2 ADD TYPE [ ]}: Displays the matching circuit type menu (see ⑦).
Sets the matching circuit type of TEST PORT 2.

{PORT2 CAP C}: Sets the capacitance C of TEST PORT 2.
When "0" is entered, the capacitance is assumed to be not connected and ignored.

{PORT2 CAP G}: Sets the conductance G for the capacitance of TEST PORT 2.

{PORT2 IND L}: Sets the inductance L of TEST PORT 2.
When "0" is entered, the inductance is assumed to be not connected and ignored.

{PORT2 IND R}: Set the resistance R for the inductance of TEST PORT 2.

{Return}: Returns to the port condition menu.

{More 2/4}: Moves to the 3 of 4 page.

- 3 of 4 page

{PORT3 ADD CIRCUIT ON/OFF}:
Selects ON/OFF of the matching circuit function for TEST PORT 3.

{PORT3 ADD TYPE [ ]}: Displays the matching circuit type menu (see ⑦).
Sets the matching circuit type of TEST PORT 3.

{PORT3 CAP C}: Sets the capacitance C of TEST PORT 3.
When "0" is entered, the capacitance is assumed to be not connected and ignored.

{PORT3 CAP G}: Sets the conductance G for the capacitance of TEST PORT 3.

{PORT3 IND L}: Sets the inductance L of TEST PORT 3.
When "0" is entered, the inductance is assumed to be not connected and ignored.

{PORT3 IND R}: Set the resistance R for the inductance of TEST PORT 3.

{Return}: Returns to the port condition menu.

{More 3/4}: Moves to the 4 of 4 page.

- 4 of 4 page

{PORT4 ADD CIRCUIT ON/OFF}:
Selects ON/OFF of the matching circuit function for TEST PORT 4.

{PORT4 ADD TYPE [ ]}: Displays the matching circuit type menu (see ⑦).
Sets the matching circuit type of TEST PORT 4.

{PORT4 CAP C}: Sets the capacitance C of TEST PORT 4.
When "0" is entered, the capacitance is assumed to be not connected and ignored.

{PORT4 CAP G}: Sets the conductance G for the capacitance of TEST PORT 4.

{PORT4 IND L}: Sets the inductance L of TEST PORT 4.
When "0" is entered, the inductance is assumed to be not connected and ignored.

{PORT4 IND R}: Set the resistance R for the inductance of TEST PORT 4.

{Return}: Returns to the port condition menu.

{More 4/4}: Moves to the 1 of 4 page.

Note: ***Even when the matching circuit function is set to ON for each port, the function does not operate while the software fixture function is set to OFF.***

⑦ Matching circuit type menu

{PORTn C(P)-L(S)-D}: Sets the matching circuit of TEST PORT n to the type of parallel C to series L.

{PORTn L(P)-C(S)-D}: Sets the matching circuit of TEST PORT n to the type of parallel L to series C.

{PORTn C(S)-L(P)-D}: Sets the matching circuit of TEST PORT n to the type of series C to parallel L.

{PORTn L(S)-C(P)-D}: Sets the matching circuit of TEST PORT n to the type of series L to parallel C.

{PORTn L(P)-C(P)-D}: Sets the matching circuit of TEST PORT n to the type of parallel L to parallel C.

{PORTn USE CIRCUIT}: Sets the user defined circuit of TEST PORT n.
Sets the matching circuit specified by the file.

{LOAD USE CIRCUIT}: Displays the matching circuit user defined circuit menu (see ⑩).
Reads the user defined circuit file from the floppy disk.

{Return}: Returns to the matching circuit menu.

Note: ***"n" of TEST PORTn indicates the port number.***

⑧ Balance measurement menu

{MATCHING BALANCE P1}: Displays the balanced matching circuit menu (see ⑨). Sets the balanced matching circuit of balanced PORT 1.

{MATCHING BALANCE P2}: Displays the balanced matching circuit menu (see ⑨). Sets the balanced matching circuit of balanced PORT 2.

{BALANCE PARAMETER ON/OFF}: Selects ON/OFF of the degree of balance measurement function.
When the degree of balance measurement function is set to ON, the MEAS menu is changed (see ⑮).

{FLOAT BALUN ON/OFF}: Selects ON/OFF of the floating balun of the software balun function.
When the floating balun is set to ON, the MEAS menu is changed (see ⑮).

{DIFF BALUN ON/OFF}: Selects ON/OFF of the differential balun of the software balun function.
When the differential balun is set to ON, the MEAS menu is changed (see ⑮).

{Return}: Returns to the software fixture menu.

Note: ***Even when the degree of balance measurement function is set to ON, the function does not operate while the software fixture function is set to OFF.***

⑨ Balanced matching circuit menu

{BALANCE Pn C(P)-L(P)-D ON/OFF}: Selects ON/OFF of the balanced matching circuit function for balanced PORT n.

{BALANCE Pn CAP C}: Sets the capacitance C of balanced PORT n.
When "0" is entered, the capacitance is assumed to be not connected and ignored.

{BALANCE Pn CAP G}: Sets the conductance G for the capacitance of balanced PORT n.

{BALANCE Pn IND L}: Sets the inductance L of balanced PORT n.
When "0" is entered, the inductance is assumed to be not connected and ignored.

{BALANCE Pn IND R}: Sets the resistance R for the inductance of balanced PORT n.

{Return}: Returns to the balance measurement menu.

Note: ***Even when the balanced matching circuit function is set to ON, the function does not operate while the software fixture function is set to OFF.***

⑩ User defined circuit menu

{LOAD ADD S1P}:	Displays the 1-port matching circuit file menu (see ⑪). This menu is used to read the user defined circuit file for S1P data.
{LOAD ADD S2P}:	Displays the 2-port matching circuit file menu (see ⑫). This menu is used to read the user defined circuit file for S2P data.
{LOAD DEL S2P}:	Displays the network elimination file menu (see ⑬). This menu is used to read the user defined circuit file for the network elimination function.
{Return}:	Returns to the software fixture menu.

⑪ 1-port matching circuit file menu

{LOAD sfadd1.s1p}:	Reads the 1-port matching circuit file “sfadd1.s1p” for TEST PORT 1.
{LOAD sfadd2.s1p}:	Reads the 1-port matching circuit file “sfadd2.s1p” for TEST PORT 2.
{LOAD sfadd3.s1p}:	Reads the 1-port matching circuit file “sfadd3.s1p” for TEST PORT 3.
{LOAD sfadd4.s1p}:	Reads the 1-port matching circuit file “sfadd4.s1p” for TEST PORT 4.
{Return}:	Returns to the user defined circuit menu.

⑫ 2-port matching circuit file menu

{LOAD sfadd1.s2p}:	Reads the 2-port matching circuit file "sfadd1.s2p" for TEST PORT 1.
{LOAD sfadd2.s2p}:	Reads the 2-port matching circuit file "sfadd2.s2p" for TEST PORT 2.
{LOAD sfadd3.s2p}:	Reads the 2-port matching circuit file "sfadd3.s2p" for TEST PORT 3.
{LOAD sfadd4.s2p}:	Reads the 2-port matching circuit file "sfadd4.s2p" for TEST PORT 4.
{Return}:	Returns to the user defined circuit menu.

⑬ Network elimination file menu

{LOAD sfdel1.s2p}:	Reads the network elimination file "sfdel1.s2p" for TEST PORT 1.
{LOAD sfdel2.s2p}:	Reads the network elimination file "sfdel2.s2p" for TEST PORT 2.
{LOAD sfdel3.s2p}:	Reads the network elimination file "sfdel3.s2p" for TEST PORT 3.
{LOAD sfdel4.s2p}:	Reads the network elimination file "sfdel4.s2p" for TEST PORT 4.

{Return}: Returns to the user defined circuit menu.

⑭ Data saving menu

{SAVE TS}: Saves all items of measurement data in T.S file format on the floppy disk.

{SAVE CSV}: Saves all items of measurement data in CVS file format on the floppy disk.

{SAVE CSV DISP}: Saves measurement data displayed on the active channel in CVS file format on the floppy disk. When the 2-trace display mode is used, the first trace data is saved.

{FILE FORMAT DB/RI}: Selects the type of data to be saved.

DB: Data type of magnitude (dB) and phase (deg)

RI: Data type of a complex number with a real part and imaginary part

{Return}: Returns to the software fixture menu.

⑮ Changing the MEAS menu

When the degree of balance measurement function, software balun function or mode analysis function is set to ON, the MEAS menu is changed as shown below.

- When the degree of balance measurement function is set to ON

1. When measuring a 3-port device

{B32}: Sets the measurement parameter to B32.

{B23}: Sets the measurement parameter to B23.

{SUB MEAS ON/OFF}: Set ON/OFF of SUB MEAS.

2. When measuring a 4-port device

{B21}: Sets the measurement parameter to B21.

{B12}: Sets the measurement parameter to B12.

{B43}: Sets the measurement parameter to B43.

{B34}: Sets the measurement parameter to B34.

{SUB MEAS ON/OFF}: Set ON/OFF of SUB MEAS.

- When the software balun function is set to ON

{SS11}: Sets the measurement parameter to SS11.

{SS21}: Sets the measurement parameter to SS21.

{SS12}: Sets the measurement parameter to SS12.

{SS22}: Sets the measurement parameter to SS22.

{SS11&SS21}: Sets the measurement parameter to SS11&SS21.

{SS22&SS12}: Sets the measurement parameter to SS22&SS12.

{SUB MEAS ON/OFF}: Set ON/OFF of SUB MEAS.

- When the mode analysis function is set to ON

{Sdd}: Sets the mode analysis to the differential mode input and differential mode output mode.

{Sdc}: Sets the mode analysis to the common mode input and differential mode output mode.

{Scd}: Sets the mode analysis to the differential mode input and common mode output mode.

{Scc}: Sets the mode analysis to the common mode input and common mode output mode.

{11}: Sets the measurement parameter to the forward direction (PORT 1) reflection characteristics.

{21}: Sets the measurement parameter to the forward direction (PORT 1 through PORT 2) transmission characteristics.

{12}: Sets the measurement parameter to the reverse direction (PORT 2 through PORT 1) reflection characteristics.

{22}: Sets the measurement parameter to the reverse direction (PORT 2) reflection characteristics.

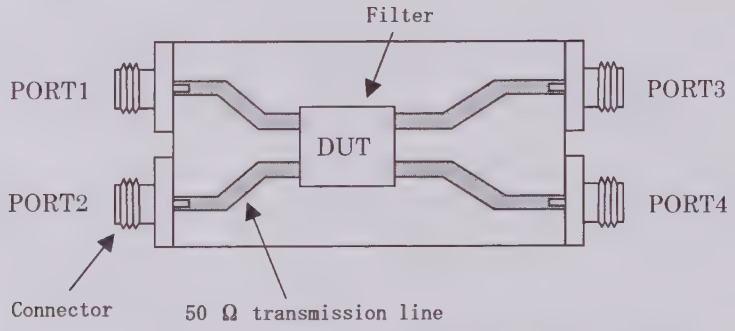
7.10.3 Measurement Example

The measurement example of a filter with balanced input and balanced output (4-port device) is given below.

The filter is measured in a condition where it is installed on the jig as shown in Figure 7-17. PORT 1 and PORT 2 are balanced input and PORT 3 and PORT 4 are balanced output.

This measurement needs OPT 14 and OPT 71.

7.10.3.1 Measurement Jig



Electrical lengths of each port
PORT 1 to DUT transmission line: 70 psec
PORT 2 to DUT transmission line: 70 psec
PORT 3 to DUT transmission line: 135 psec
PORT 4 to DUT transmission line: 135 psec

Figure 7-17 Measurement Jig for Balanced Input and Balanced Output Filter

7.10.3.2 Operation Procedure

The following steps (1) through (4) give explanations of basic settings for the software fixture function.

The step (5) gives an explanation of the execution (measurement) of the software fixture function.

(1) Performing calibration

Set the frequencies in accordance with the filter to CENTER 200 MHz and SPAN 300 MHz to perform a 4-port calibration.
For more information on a calibration procedure, refer to Section 7.5.12, "4-Port Calibration."
When the R17050 Automatic Calibration Kit is used, refer to the R17050 operation manual.

(2) Setting the port extension

The port extension is set to remove the influence of the measurement jig. The port extension function extends a calibration plane from the connector edge to the device (or filter) edge.
[FUNCTION] → *{SOFTWARE FIXTURE}* → *{PORT CONDITION}* →
{EXTENSION PORT1} →70[p]
{EXTENSION PORT2} →70[p]
{EXTENSION PORT3} →135[p]
{EXTENSION PORT4} →135[p]
{EXTENSION ON}

Note: ***When the matching circuit function or software balun function is set to ON without executing the port extension, the matching circuit or software balun is added to the PORT edge, not to the device edge. This causes you to measure characteristics which are different from the characteristics of the device itself.***

(3) Setting the impedance conversion

Since the device used in this measurement is a 50Ω device, transform the impedance of each port to 50Ω. When the impedance is already set to 50Ω, impedance conversion can be omitted.

Note: ***The device used in this example has an input impedance of 50Ω for each port, but has an input/output impedance (balanced port impedance) of 100Ω as a balanced device.***

[FUNCTION] → *{SOFTWARE FIXTURE}* → *{PORT CONDITION}* →
{NORMALIZED IMPEDANCE [ ]} →
{PORT1 IMPEDANCE} →50[X1]
{PORT2 IMPEDANCE} →50[X1]
{PORT3 IMPEDANCE} →50[X1]
{PORT4 IMPEDANCE} →50[X1]
{IMPEDANCE TRANSFORM ON}

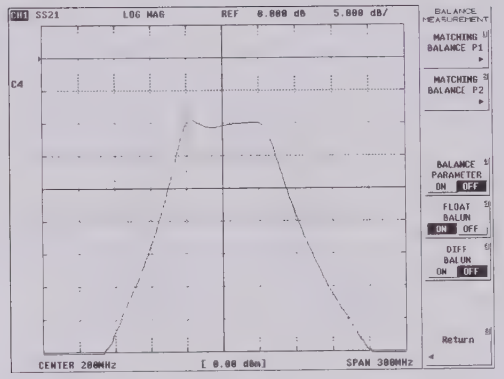
(4) Setting the software balun

Add the software balun to convert a 4-port device to a 2-port device for measurement.
[FUNCTION] → *{SOFTWARE FIXTURE}* → *{BALANCE MEASUREMENT}* →
{FLOAT BALUN ON}

(5) Executing the software fixture function

Execute the software fixture function to measure the transmission characteristics SS21.
[FUNCTION] → *{SOFTWARE FIXTURE}* → *{SOFTWARE FIXTURE ON}*
[MEAS] → *{SS21}* →

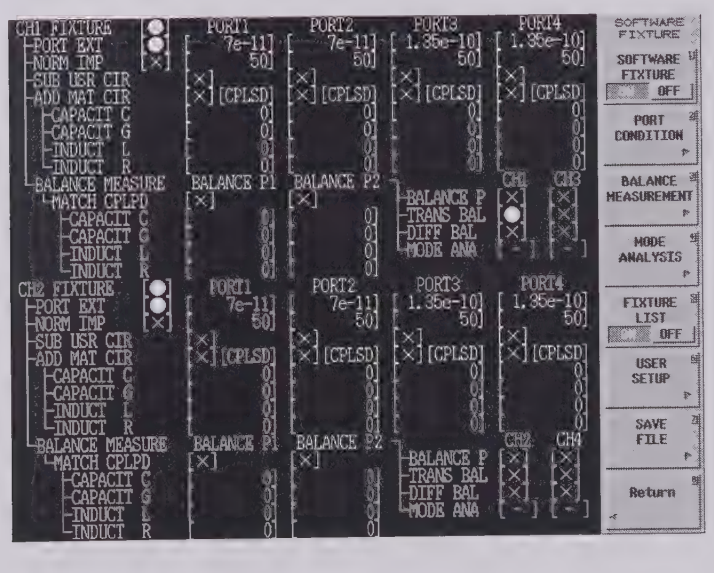
The transmission characteristics of the balanced filter SS21 can be measured as shown below.



(6) Checking the software fixture settings

Check the settings using the software fixture setting list display.
[FUNCTION] → *{SOFTWARE FIXTURE}* → *{FIXTURE LIST ON}*

A list of settings is displayed as shown below. The function marked with ○ is set to ON. After checking is completed, return the screen to the measurement screen by executing *{FIXTURE LIST OFF}*.



(7) Setting the matching circuit function

Add the matching circuit to PORT 4.
The matching circuit function uses the user defined circuit file.
The user defined circuit file "sfadd4.s2p" contains data to add an inductance of 150nH and this data has been created in advance.

① Reading the user defined circuit file

Insert the floppy disk containing the user defined circuit file "sfadd4.s2p" into the floppy disk drive.
[FUNCTION] → *{SOFTWARE FIXTURE}* → *{LOAD USR CIRCUIT}* → *{LOAD ADD S2P}* → *{LOAD sfadd4.s2p}*

The user defined circuit file "sfadd4.s2p" is read from the floppy disk into the memory of this instrument. When reading is completed, a message "a:/sfadd4.s2p: Done" is displayed.

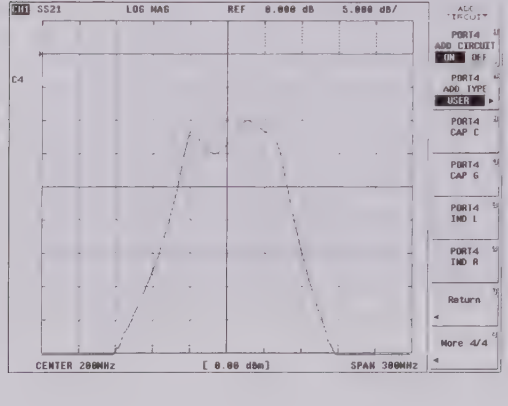
② Selecting the matching circuit type

Set the matching circuit type to the user defined circuit to execute it.
[FUNCTION] → *{SOFTWARE FIXTURE}* → *{PORT CONDITION}* → *{ADD CIRCUIT}* → *{More 1/4}* → *{More 2/4}* → *{More 3/4}* → *{PORT4 ADD TYPE[ ]}* → *{PORT4 USR CIRCUIT}*

③ Executing the matching circuit function

Execute the matching circuit function.
{Return} → *{PORT4 ADD CIRCUIT ON}*

When this matching circuit is added, the network actually gets out of balance and the waveform is greatly deformed.



(8) Setting the network elimination function

Delete the network equivalent to the matching circuit added to PORT 4.
The user defined circuit file "sfdel4.s2p" contains data created in advance.

① Reading the user defined circuit file

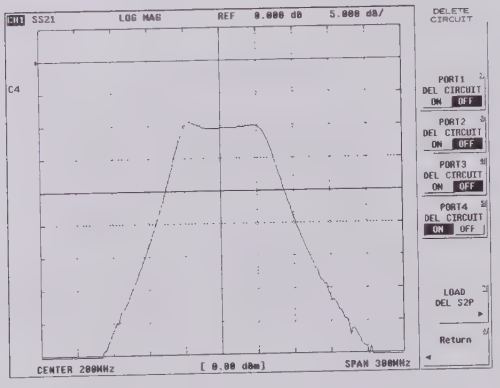
Insert the floppy disk containing the user defined circuit file "sfdel4.s2p" into the floppy disk drive.
[FUNCTION] → *{SOFTWARE FIXTURE}* → *{LOAD USR CIRCUIT}* → *{LOAD DEL S2P}* → *{LOAD sfdel4.s2p}*

The user defined circuit file "sfdel4.s2p" is read from the floppy disk into the memory of this instrument. When reading is completed, a message "a:/sfdel4.s2p: Done" is displayed.

② Executing the network elimination function

Execute the network elimination function.
[FUNCTION] → *{SOFTWARE FIXTURE}* → *{PORT CONDITION}* → *{DELETE CIRCUIT}* → *{PORT4 DEL CIRCUIT ON}*

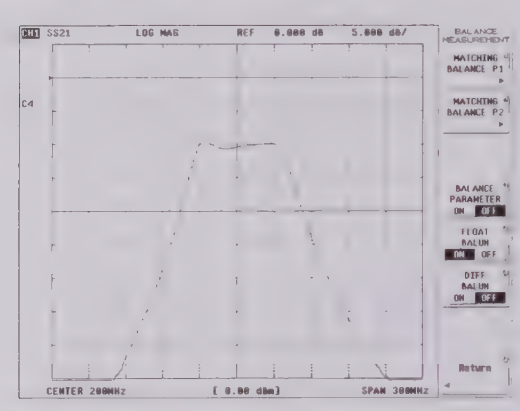
The waveform greatly deformed returns to the waveform generated before the matching circuit is added.



(9) Setting the differential balun

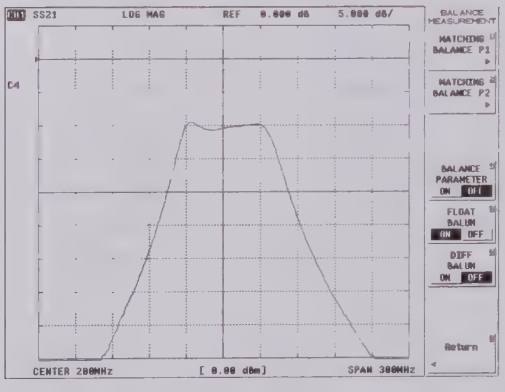
Change the software balun from the floating balun to the differential balun.
[FUNCTION] → *{SOFTWARE FIXTURE}* → *{BALANCE MEASUREMENT}* → *{DIFF BALUN ON}*

Since the filter used in this measurement is balanced, the difference between the floating and differential baluns does not appear.

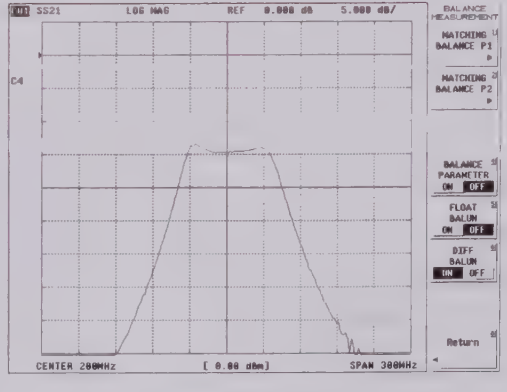


(Reference)
When measuring an unbalanced type of a filter, the difference between the floating and differential baluns is easy to see.

- Measurement example of an unbalanced filter (SS21)



Floating balun

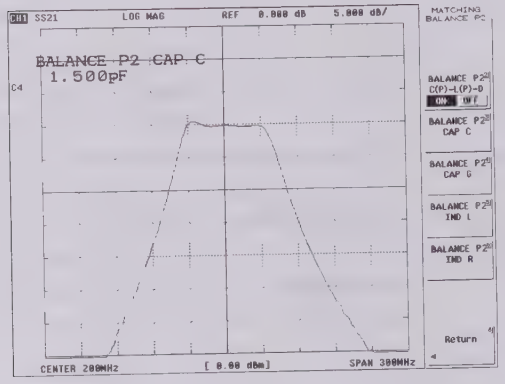


Differential balun

(10) Setting the balanced matching circuit

Add a capacitor of 1.5pF as a balanced matching circuit between PORT 3 and PORT 4 (balanced port 2).
[FUNCTION] → *{SOFTWARE FIXTURE}* → *{BALANCE MEASUREMENT}* →
{MATCHING BALANCE P2}
{BALANCE P2 CAP C} →1.5[p]
{BALANCE P2 C(P)-L(P)-D ON}

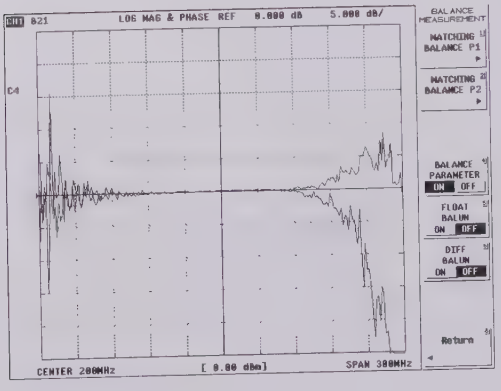
The measurement results show that the network is balanced and the ripple in the pass band decreases.



(11) Measuring the degree of balance

Measure the degree of balance between PORT 1 and PORT 2.
[FUNCTION] → *{SOFTWARE FIXTURE}* → *{BALANCE MEASUREMENT}* →
{BALANCE PARAMETER ON}
[MEAS] → *{B21}*

As shown below, the balance is remarkably achieved in the pass band. When the balance is achieved, the degree of balance is 0dB and 0 degree.



Setting conditions

FORMAT:	LOGMAG&PHASE
1st SCALE:	REF.POSION 50%
	REF.VALUE 0dB
	5dB/DIV
2nd SCALE:	REF.POSION 50%
	REF.VALUE 0deg
	45deg/DIV

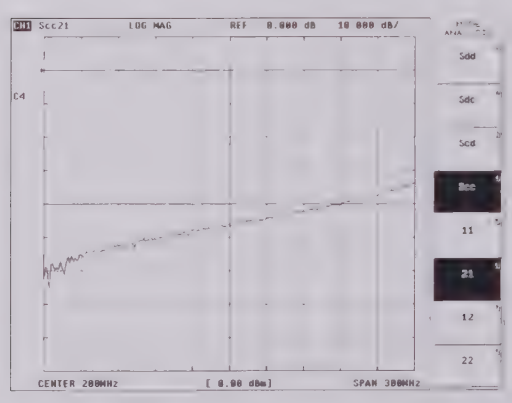
(12) Executing the mode analysis function

This function breaks down the signal into common mode and differential mode components.
[FUNCTION] → *{SOFTWARE FIXTURE}* → *{MODE ANALYSIS ON}*

① Measurement of common mode input and common mode output

[MEAS] → *{Scc}*, *{21}*

The measurement results show that the common mode component is transmitted with its magnitude eliminated by approximately 45dB at the center frequency.

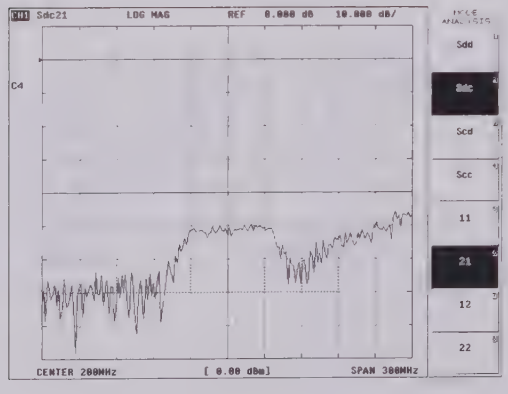


Setting conditions
FORMAT: LOGMAG
SCALE: REF.POSION 90%
REF.VALUE 0dB
10dB/DIV

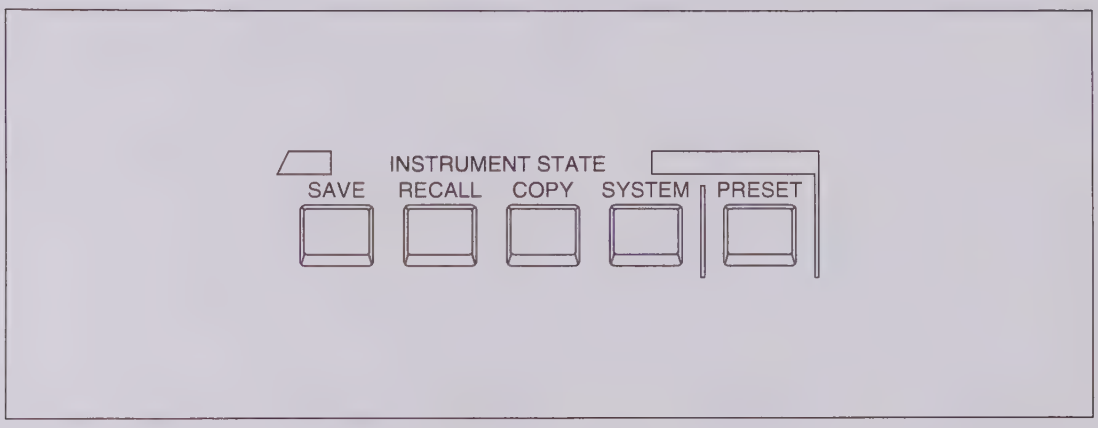
② Measurement of common mode input and differential mode output

[MEAS] → *{Sdc}*, *{21}*

The measurement results show that the common mode component is transmitted with its magnitude converted into differential mode by approximately -50dB at the center frequency.



7.11 INSTRUMENT STATE Block



The INSTRUMENT STATE block is used to set the system control functions which have no concern with the measurement. The functions are provided such as a time/date set, limit-line test, save/recall, and hard copy.

[SAVE] : Calls the save menu to save such as a setting data and calibration data of the R3765/67G series. (Refer to sub-section 7.14.1.)

[RECALL] : Calls the recall menu to recall such as a setting data and calibration data of the R3765/67G series. (Refer to sub-section 7.14.8.)

[COPY] : Calls the copy menu to execute the hard copy of screen for a plotter/printer. (Refer to section 7.15.)

[SYSTEM] : Calls the system menu to set such as an internal disk, date/time display and limit line. (Refer to sub-section 7.11.1.)

[PRESET] : Initializes the settings of the R3765/67G series. (Refer to section 4.4.)

7.11.1 System Menu

The Setting and the Explanation

① Press the **[SYSTEM]** to call the system menu. (Refer to section A.4.)

② System menu

{SYSTEM DRIVE} : Calls the system for selecting a drive to be used and format type of the disk. (See step ③.)

{SET CLOCK} : Calls the real-time clock menu for setting a date/time. (See step ⑥.)

{LIMIT MENU} : Calls the limit menu. (Refer to sub-section 7.12.1)

{SYSTEM CONFIG} : Calls the system configuration menu (refer to Section 7.11.2).

{SERVICE MENU} : Calls the service menu.

③ System drive menu

{DEFAULT DRIVE} : Calls the default drive menu.(See step ④.)
A drive selected on this menu is set as a current drive when power is turned on.

{FORMAT TYPE} : Calls the disk format menu for selecting an initialize format type. (See step ⑤.)

④ Default drive menu

{A:} : Selects the drive A.
Floppy disk drive (720kB, 1.2MB, 1.44MB) (*1)

{B:} : Selects the drive B.
RAM disk drive (2MB, without backup) (*2)

{C:} : Selects the C drive.
Compact flash disk drive (with backup). (*3)
The standard capacity is 8 MB. When OPT11 is installed, the capacity is 32 MB.

{D:} : Selects the D drive.
Compact flash disk drive (with backup). (*3)

(*1) Floppy disks used for this instrument are formatted as FAT16 using MS-DOS Ver. 3.0. In addition, the built-in disk drive is compatible to three formats, however, the instrument can format floppy disks with 720 KB (2DD) and 1.44 MB (2HD) only. (See step ⑤.)

(*2) Part of the built-in memory (DRAM) is allocated to the disk drive. When the power supply is turned off once, all of the created files are deleted. Therefore, the B drive should be restricted to the use of temporary files when used to create the BASIC program.

(*3) The instrument is equipped with a compact flash disk used as a memory device.
This disk is divided into multiple partitions, which are used depend-

ing on applications.

C: This can be used freely. However, the registers used in the SAVE function are created on the C drive; therefore, depending on how the SAVE registers are used, the actual user capacity differs.

D: This is used to save files required for firmware. The contents of firmware vary depending on the firmware version.

⑤ Disk format menu

{1.44MB} : Specifies the format to 2HD, 1.44 MB (the same as the 2HD format of the IBM PC/AT compatible machine) when initializing the floppy disk. The logical format is a file system in the MS-DOS Ver. 3.0 FAT format.
This function is ignored when using the2DD floppy disk.

{720KB} : Specifies the format to 2DD, 720 KB (the same as the 2DD format of the IBM PC/AT compatible machine) when initializing the floppy disk. The logical format is a file system in the MS-DOS Ver. 3.0 FAT format.
This function is ignored for the 2HD floppy disk.

⑥ Real-time clock menu

{YEAR} : Sets a year. (*1)

{MONTH} : Sets a month.

{DAY} : Sets a day.

{HOUR} : Sets an hour.

{MINUTE} : Sets a minute.

{SECOND} : Sets a second.

(*1) The year can be set within the range of 1999 to 2029 using a two-digit number (or smaller), or a four-digit number. The following rules are applied when a two-digit number (or smaller) is used

Input	Rule
00 to 29	Numbers are set as 2000 A.D. to 2029 A.D.
99	Number is set as 1999 A.D.

If the numbers used do not meet the above rules, they are ignored.

7.11.2 System Configuration

This function changes the start-up status and the configuration of firmware elements independent of the measurement function.
The contents set by this function are retained independently and do not affect the SAVE register function or the STORE file function.

Setting and description

① Press **[SYSTEM]** to call the system menu (refer to Section A.4).

② Press *{SYSTEM CONFIG}* to call the system configuration menu.

③ System configuration menu

{KEYBOARD 101/106} : Selects the type of the keyboard.
The PS/2 type keyboard of the IBM PC/AT compatible machine can be used.
Switching between using the 101 type English keyboard and the 106 type Japanese keyboard is possible.

{COLOR SCHEME} : Calls the color scheme menu. (See ④.)

{CUSTOM FIRMWARE} : Calls the custom firmware menu. (See ⑤.)

④ Color scheme menu.

This function changes the color definition information at a time.
Color schemes have been set to the default of six samples in the factory.

{SCHEME-1} : Applies the color scheme 1.

{SCHEME-2} : Applies the color scheme 2.

{SCHEME-3} : Applies the color scheme 3.

{SCHEME-4} : Applies the color scheme 4.

{SCHEME-5} : Applies the color scheme 5.

{SCHEME-6} : Applies the color scheme 6.

⑤ Custom firmware menu

Customized firmware used for special purposes is available.
For more information, contact your sales representative or the nearest ADVANTEST sales office.
This firmware is not installed when the instrument is shipped from the factory.

{CUSTOM-1} : Selects the custom firmware 1 (Note).

{CUSTOM-2} : Selects the custom firmware 2 (Note).

{CUSTOM-3} : Selects the custom firmware 3 (Note).

{CUSTOM-4} : Selects the custom firmware 4 (Note).

{CUSTOM-5} : Selects the custom firmware 5 (Note).

{CUSTOM-6} : Selects the custom firmware 6 (Note).

{OFF} : Returns to the standard firmware (Note).

Note: ***Those functions are enabled when the power supply is turned off once, and then turned on again.***

7.11.3 Service Function

This section describes the service functions installed in the instrument for maintenance purposes.
For more information about this function, contact your sales representative or the nearest ADVANTEST sales office.

Setting and description

① Press **[SYSTEM]** to call the system menu. (See Section A.4.)

② Press *{SERVICE MENU}* to call the service menu.

③ Service menu

{INTERNAL TEST}	:	Calls the self-diagnostic menu. For more information on the self-diagnostic menu, refer to the maintenance manual (Note).
{SERVICE MODE}	:	Calls the service mode menu. For more information on the service mode menu, refer to the maintenance manual (Note).
{VERIFICATION}	:	This function is used to verify measurement errors obtained using the automatic calibration kit. For more information, refer to the operation manual for the R17050.
{FIRMWARE REVISION}	:	Indicates the revision of firmware.

Note: ***For more information about the maintenance manual, contact your sales representative or the nearest ADVANTEST sales office.***

7.12 Limit Function

This function defines the segment for the measurement data, sets the upper limit and the lower limit for the segment, and judges pass/fail comparing with the data.

The limit can be set in each channel (CH1 and CH2) and in each sub-measure screen (CH3 and CH4) independently.

How to output the pass/fail judgement is as follows.

- PASS or FAIL is displayed on the screen.
- The beep can be set. When the limit test passes or fails, the beep sounds.
- Displays the trace in the Fail section with red.
- In the case of fail, sets Limit Fail Summary-Bit of Questionable Status Register.
- In the case of fail, set LOW Status on the parallel I/O port of the rear panel.

7.12.1 Limit Menu

The setting and the explanation

① Press **[SYSTEM]** to call the system menu. (Refer to section A.4.)

② Press *{LIMIT MENU}* to call the limit menu. (See step ③.)

③ Limit menu

{LIMIT LINE ON/OFF} : Selects ON or OFF in the display of limit line.
When the limit line is set and this is in the state of ON, the limit line is displayed to compare the measurement data on the scale.
The displays of the limit line are different depending on DISPLAY FORMAT and LIMIT TYPE of the segment.
In the format of rectangular coordinate, ∧ and ∨ marks or lines (straight lines or horizontal lines) are put between break points of each segment.
In the polar coordinates, circle or straight line showing the angle is drawn.

{LIMIT TEST ON/OFF} : Selects ON/OFF of the limit test.
Under the limit test ON, the limit values and the data setting at each measurement point are compared.
The limit test is performed when the data was updated during sweeping or after swept, or when the limit test was set to ON for the first time.

{BEEP [ ]} : Calls the beep mode menu and sets the beep for the limit test. (See step ④.)

{LIMIT MODE MENU} : Calls the limit mode menu to control the limit test mode and select the limit type of polar coordinate format. (See step ⑤.)

{EDIT LIMIT LINE} : Calls the edit limit menu (1 of 2) to display the list (Limit Line Editor) of limit line segment in the lower half of the display to change the limit setting. (See step ⑥.)

{SELECT DATA 1ST/2ND}: Switches the judgement parameter to operate.
2 parameters per channel can be specified for the judgement parameter.
In the display format of the rectangular coordinates, they corresponds to the first trace and the second trace.
In the display format of polar coordinates, they corresponds to the judgement parameters selected in LIMIT MODE MENU.

{LIMIT LINE OFFSETS} : Calls the offset limit menu to adjust the stimulus value and the response value of the limit. (See step ⑪.)

④ Beep mode menu

{OFF} : Turns the beep off for the limit test.

{FAIL} : Sounds the beep when the limit test detects fail.

{PASS} : Sounds the beep when the limit test detects pass.

{BEEP TONE} : Selects the beep tone from 0 to 7.
Zero indicates the lowest tone and the beep tone is proportional to the numeric value of 0 to 7.

⑤ Limit mode menu

{1ST DATA ON/OFF} : Sets the first parameter ON/OFF.
Judgement of the first parameter limit is performed when the LIMIT TEST is set to ON and also the 1ST DATA is set to ON.

{2ND DATA ON/OFF} : Sets the second parameter ON/OFF.
Judgement of the second parameter limit is performed when the LIMIT TEST is set to ON and also the 2ND DATA is set to ON.
But the judgement is not performed if effective 2nd trace data does not exist in the display format of polar coordinates selected.

{MAG DATA LIN/LOG} : The limit test of Smith chart and polar display is judged with MAG and PHASE.
Select whether this judgement is performed with LIN (linear scale) or LOG (logarithmic scale) of MAG DATA. (Default setting is LOG.)
This soft menu is effective only when the format (refer to sub-section 7.4.2) is of Smith chart or polar display.

⑥ Edit limit menu (1 of 2)

{SEGMENT} : Selects a segment number to edit.
Up to 31 segments can be set with starting number 0.
Up to 7 segments can be displayed at a time and scroll-displayed on the Limit Line Editor.
When no segment was set, 0 is displayed on the active area, and in other cases, the next number to the last specified segment is displayed.
But soon after the edit limit menu is called, the largest number of the set segments is displayed.
Also the segment number is not updated after the last segment was set.

{SELECT DATA 1ST/2ND}: Switches the judgement parameter to operate.
2 parameters per channel can be specified for the judgement parameter.
In the display format of the rectangular coordinates, they corresponds to the first trace and the second trace.
In the display format of the polar coordinates, they corresponds to the judgement parameters selected in LIMIT MODE MENU.

{EDIT SEGMENT} : Calls the edit segment menu to set and change the stimulus value and upper/lower limit value of the specified segment. (See step ⑧.)
If the Limit Table is empty, the segment with initial setting is displayed.
Also, if an empty segment exists between the largest current set segment and the specified segment, the specified segment number is ignored.
In this case, the operation is the same as ADD SEGMENT soft key operation.

{DELETE} : Deletes the segment shown with a cursor >.
But if the specified segment is empty, this operation is ignored.

{ADD SEGMENT} : Calls the edit segment menu to add a new segment at the end of the Limit Table. In the new segment, initial value is inputted. The initial value is the setting of segment which was selected at SEGMENT and shown with cursor.

{LIMIT TYPE} : Calls the limit type menu to select current segment type selected with >. (See step ⑩.)

{DONE} : Sorts the input segments in ascending stimulus order and returns to the limit menu.
The updated limit becomes effective by pressing DONE soft key.

{More 1/2} : Calls the edit limit menu (2 of 2). (See step ⑦.)

⑦ Edit limit menu (2 of 2)

{LIMIT LINE ON/OFF} : Selects ON or OFF of the limit line display.
When the limit line is set and this is in the state of ON, the limit line is displayed to compare the measurement data on the scale.
The displays of the limit line are different depending on DISPLAY FORMAT and LIMIT TYPE of the segment.
In the format of rectangular coordinates, ∧ and ∨ marks or lines (straight lines or horizontal lines) are put between the break points of each segment.
In polar coordinate, circle or straight line showing the angle is drawn.

{LIMIT TEST ON/OFF} : Selects ON/OFF of the limit test.
Under the limit line ON, the limit values and the data are compared at each measurement point.
The limit test is performed when the data was updated during sweeping or after swept, or when the limit test was set to ON for the first time.

{BEEP [ ]} : Calls the beep mode to set the beep for the limit test. (See step ④.)

{MAG DATA LIN/LOG} : The limit test of Smith chart and polar display is judged with MAG and PHASE.
Select whether this judgement is performed with LIN (linear scale) or LOG (logarithmic scale). (Default setting is LOG.)
This soft menu is effective only when the format (refer to sub-section 7.4.2.) is of Smith chart or polar display.

{LIMIT MODE MENU} : Calls the limit mode menu to control the limit test mode and selects the limit type of polar coordinates format. (See step ⑤.)

{LIMIT LINE OFFSETS} : Calls the offset limit menu to adjust the stimulus value and the response value of the limit. (See step ⑪.)

{CLEAR LIST} : Calls the clear limit menu to clear all the segments in the limit table. (See step ⑨.)

⑧ Edit segment menu

{STIMULUS VALUE} : Sets stimulus value of the segment with ENTRY block.

{MARKER TO STIMULUS}: Sets stimulus value of the segment with active marker. Turning the data knob moves the active marker right and left.

{UPPER LIMIT} : Sets the upper limit value of the segment.
It is necessary to set both values, upper limit and lower limit.
If the upper limit value is not required, set an extreme large value for the upper limit value.
Pressing *{UPPER LIMIT}* or *{LOWER LIMIT}* key changes limit values displayed on the screen into upper/lower expression, even if they are set with middle/delta values.
If a value smaller than the lower limit is input for the upper limit value or the reverse, the same values are set for both the limit values.

{LOWER LIMIT} : Sets the lower limit value of the segment.
It is necessary to set both values, upper limit and lower limit.
If the lower limit value is not required, set an extreme small value for the lower limit value.

{DELTA LIMIT} : Sets the limit width of the segment.
The limit width is expressed with the center value set by *{MIDDLE VALUE}*.
For example, to set the pass area within -5dB ±3dB, enter -5dB as the center value and 6dB as the delta value.
Pressing *{MIDDLE LIMIT}* or *{DELTA LIMIT}* key changes limit values displayed on the screen into upper/lower expression, even if they are set with DELTA/MIDDLE values.

{MIDDLE VALUE} : Sets the middle value of DELTA LIMIT.

{MARKER TO MIDDLE} : Sets the middle value to the active marker position.

⑨ Clear limit menu

{YES} : Clears the Limit Table and returns to the edit limit menu.

{NO} : Returns to the edit limit menu without clearing the Limit Table.

⑩ Limit type menu

{SLOPING LINE} : Connects to the limit value of the next segment break point with a sloped line.
For the final segment, horizontal lines are drawn to the largest point of stimulus.
For the display format of polar coordinates, the limit value is fixed up to the next segment break point.
In this case, the result is the same as flat line.
The slope line segment is displayed with SLIN in the Limit Table.

{FLAT LINE} : Horizontal lines are drawn up to the next segment break point.
The limit value is fixed up to the next segment if the next segment has different limit value.
For the final segment, horizontal lines are drawn to the largest point of stimulus.
Flat line segment is displayed with FLIN in the Limit Table.

{SINGLE POINT} : The judgement is performed at a single stimulus point.
The upper limit is displayed with ∨ on the display, and the lower limit is displayed with ∧.
The single point segment can be used for the terminal of flat line or sloping line.
Single point segment is displayed with SPO in the Limit Table.

{LIMIT COLOR} : Sets line color.
Color-to-setup number relationship is as follows.
2 ; Red
3 ; Purple
4 ; Green
5 ; Blue
6 ; Yellow
7 ; White

{WAVE COLOR} : Sets trace data color in Fail section.
The relationship of color-to-setup number is the same as above *{LIMIT COLOR}*.

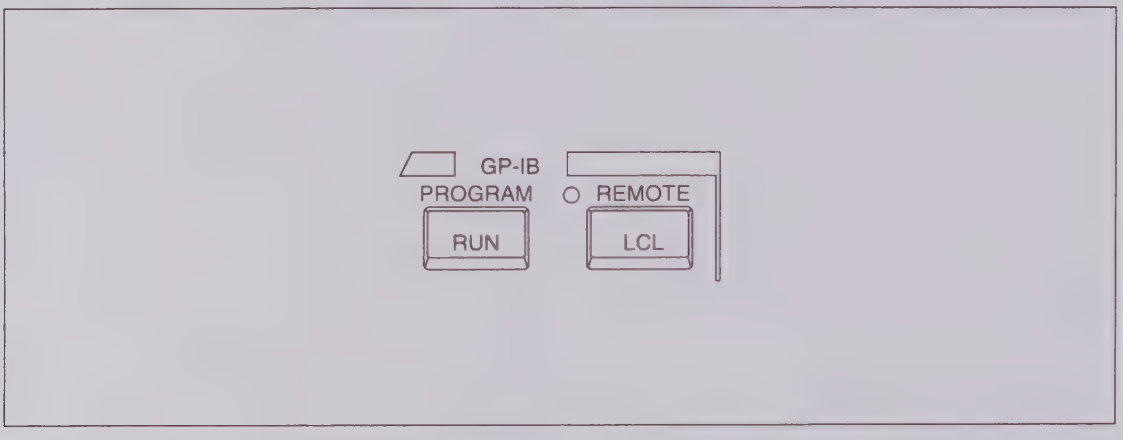
⑪ Offset limit menu

{STIMULUS OFFSET} : Adds/subtracts offset value to/from stimulus value of all segments.
Input offset value by using ENTRY block.

{AMPLITUDE OFFSET} : Adds/subtracts offset value to/from amplitude value of all segments.
Input offset value by using ENTRY block.

{MARKER TO AMP. OFS} : Sets offset value of magnitude value by using the active marker.

7.13 GPIB Block



The GPIB block is used to set the controller function, GPIB bus and GPIB address. For procedure how to create a program, refer to the "programming manual" of the separate volume.

PROGRAM

[RUN] : Call the BASIC controller menu. (Refer to sub-section 7.13.1.)

REMOTE

[LCL] : Calls the GPIB menu. (Refer to sub-section 7.13.2.)
Moreover, when the R3765/67G series is in the remote state by GPIB, it return back to the local state by pressing the key.

Note: The operation key of all the panel key becomes disable in the remote state except this key.

7.13.1 Controller Menu

The setting and the explanation

① Press the **[RUN]** to call the controller menu. (Refer to section A.4.)

② Controller menu

{RUN}	:	Starts a program.
{LOAD MENU}	:	Displays a file list and calls the load menu. (See step ③.)
{LIST}	:	Displays a program list.
{CLS}	:	Clears the text display on the screen.
{CONT}	:	Restarts a program from the next line immediately after program pauses.
{STOP}	:	Stops a program.

③ Load menu

{LOAD}	:	Loads the file specified by the cursor. Following the completion of load, returns to the controller menu. (See step ②.)
{CURSOR ↑}	:	Shifts up the cursor used for specifying a file.
{CURSOR ↓}	:	Shifts down the cursor used for specifying a file.
{DRIVE CHANGE}	:	Calls the drive menu to change the current drive. (See step ④.)

④ Drive menu

{A:}	:	Selects the drive A. Floppy disk drive
{B:}	:	Selects the drive B. RAM disk drive (without backup)
{C:}	:	Selects the C drive. A compact flash disk drive (with backup). (*3) The standard capacity is 8 MB. When OPT11 is installed, the capacity is 32 MB.
{D:}	:	Selects the D drive. Compact flash disk drive (with backup) (*3)

(*1) Floppy disks used for this instrument are formatted as FAT16 using MS-DOS Ver. 3.0. In addition, the built-in disk drive is compatible with three formats, however, the instrument can only format floppy disks with 720 KB (2DD) and 1.44 MB (2HD). (See ⑤.)

(*2) Part of the built-in memory (DRAM) is allocated to the disk drive. When the power supply is turned off, all created files are deleted. Therefore, the B drive should be restricted to the use of temporary files when used to create BASIC programs.

(*3) The instrument is equipped with a compact flash disk as a memory device. This disk is divided into multiple partitions, which are used depending on applications.

C: This can be used freely. However, the registers used in the SAVE function are created on the C drive; therefore, depending on how the SAVE registers are used, the actual user capacity differs.

D: This is used to save files required for firmware. The contents of firmware vary depending on the firmware version.

E: This drive is used exclusively for firmware. Writing data on this disk is impossible.

7.13.2 GPIB Menu

The setting and the explanation

① Press the **[LCL]** to call the GPIB menu. (Refer to section A.4.)

② GPIB menu

{SYSTEM CONTROLLER}: Sets the R3765/67G series to the system controller.

{TALKER LISTENER} : Sets the R3765/67G series to the talker/listener.

{SET ADDRESSES} : Calls the address menu used for setting the GPIB address. (See step ③.)

③ Address menu

{ADDRESS R3765G} : Sets the GPIB address of the R3765/67G series. (Note)

{ADDRESS PLOTTER} : Sets the GPIB address of the plotter.

{ADDRESS PRINTER} : Sets the GPIB address of the printer.

Note: R3767G is displayed for R3767G series.

7.14 Save/Recall

By using an internal disk, the R3765/67G series setting and the data saving/recalling (store/read) can be performed.

The following two methods for saving data are provided in accordance with informations to be saved and an internal disk.

- Save register : Saves the R3765/67G series setting and calibration data into compact flash disk (Drive C).
- Store file : Store the R3765/67G series setting, calibration data and measurement data on a floppy disk.
  All informations ; Drive A (floppy disk)

7.14.1 Selection of Save Type

The setting and the explanation

① Press the **[SAVE]** to call the save menu. (Refer to selection A.4.)

② Save menu

{SAVE REGISTER} : Calls the save register menu. (Refer to sub-section 7.3.2.)

{CLEAR REGISTER} : Calls the clear register menu used for clearing the stored save register. (Refer to sub-section 7.14.6.)

{STORE FILE} : Calls the store file menu used for storing files or setting file names. (Refer to sub-section 7.14.3.)
The file list (Figure 7-18) will be displayed on the screen.

{PURGE FILE} : Calls the purge file menu used for clearing the stored file. (Refer to sub-section 7.14.7.)
The file list (Figure 7-18) will be displayed on the screen.

{FORMAT DISK} : Initializes a floppy disk inserted in drive A.

Note: ***Before STORE FILE or PURGE FILE is executed, be sure to insert a formatted floppy disk to the drive.***

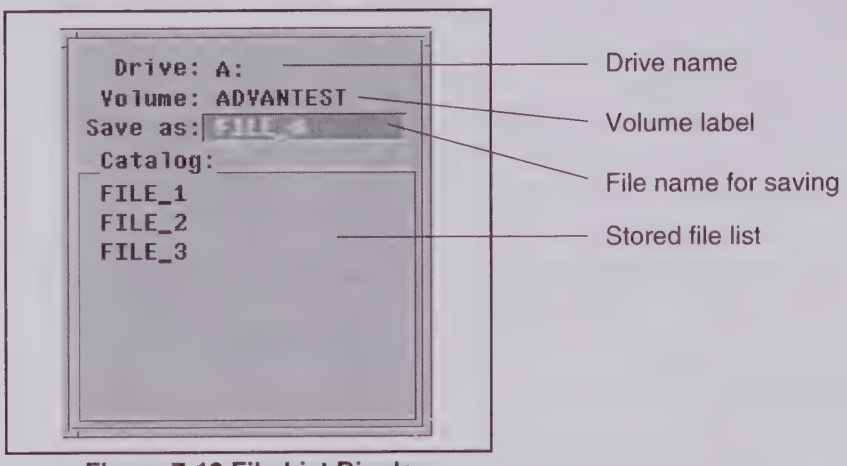


Figure 7-18 File List Display

7.14.2 Executing Save Register

Using the save register function, a maximum of 20 sets of measurement conditions and measurement data can be saved in the built-in memory in this network analyzer (each save register function saves a set of measurement conditions and measurement data).

The maximum capacity is 8 MB (*1). Data cannot be saved beyond the maximum capacity. (This is because data is saved to the C drive.) If data exceeds the maximum capacity, it cannot be saved even if less than 20 registers occupy the drive. To save data, delete some registers and save the data again (*2).

(*1) The maximum capacity is 32 MB when OPT11 is used.

(*2) To save data to the created register, delete the previous data from the register using the CLEAR register menu and execute SAVE REGISTER. (Refer to Section 7.14.6.)

The setting and the explanation

① Press the **[SAVE]** to call the save menu. (Refer to section A.4.)

② Press the *{SAVE REGISTER}* to call the save register menu.

③ Save register menu

- Save register menu (1 of 4)

  {SAVE REG-1} : Saves the settings, calibration data and memory trace data into the register 1.

  {SAVE REG-2} : Saves the settings, calibration data and memory trace data into the register 2.

  {SAVE REG-3} : Saves the settings, calibration data and memory trace data into the register 3.

  {SAVE REG-4} : Saves the settings, calibration data and memory trace data into the register 4.

  {SAVE REG-5} : Saves the settings, calibration data and memory trace data into the register 5.

{RENAME REG} : Calls the name editing menu used to define a register name. (Refer to sub-section 7.14.4.)

- Save register menu (2 of 4)

{SAVE REG-6} : Saves the settings, calibration data and memory trace data into the register 6.

{SAVE REG-7} : Saves the settings, calibration data and memory trace data into the register 7.

{SAVE REG-8} : Saves the settings, calibration data and memory trace data into the register 8.

{SAVE REG-9} : Saves the settings, calibration data and memory trace data into the register 9.

{SAVE REG-10} : Saves the settings, calibration data and memory trace data into the register 10.

{RENAME REG} : Calls the name editing menu used to define a register name. (Refer to sub-section 7.14.4.)

- Save register menu (3 of 4)

{SAVE REG-11} : Saves the settings, calibration data and memory trace data into the register 11.

{SAVE REG-12} : Saves the settings, calibration data and memory trace data into the register 12.

{SAVE REG-13} : Saves the settings, calibration data and memory trace data into the register 13.

{SAVE REG-14} : Saves the settings, calibration data and memory trace data into the register 14.

{SAVE REG-15} : Saves the settings, calibration data and memory trace data into the register 15.

{RENAME REG} : Calls the name editing menu used to define a register name. (See sub-section 7.14.4.)

- Save register menu (4 of 4)

{SAVE REG-16} : Saves the settings, calibration data and memory trace data into the register 16.

{SAVE REG-17} : Saves the settings, calibration data and memory trace data into the register 17.

{SAVE REG-18} : Saves the settings, calibration data and memory trace data into the register 18.

{SAVE REG-19} : Saves the settings, calibration data and memory trace data into the register 19.

{SAVE REG-20} : Saves the settings, calibration data and memory trace data into the register 20.

{RENAME REG} : Calls the name editing menu used to define a register name. (See sub-section 7.14.4.)

7.14.3 Executing Store File

The setting and the explanation

① Press the **[SAVE]** to call the save menu.

② Press the *{STORE FILE}* to call the store file menu.

③ Store file menu

{STORE}	:	Stores the setting data and calibration data as a file name for storing.
{ROLL ↑}	:	Scrolls the saved file list upward.
{ROLL ↓}	:	Scrolls the saved file list downward.
{DEFINE STORE}	:	Calls the file data menu used to select informations to be stored. (See step ④.)
{EDIT NAME}	:	Calls the character editing menu to define the file name for storing.
{NAME ↑}	:	Shifts the cursor up/down of the flie name for storing.
{NAME ↓}	:	
{CANCEL}	:	Cancels the file store.

④ File data menu
When ON is selected, the data is stored. (Refer to Figure 9-1.)

{STATE ON/OFF}	:	Selects ON/OFF of setting conditions data storing.
{RAW ARRAY ON/OFF}	:	Selects ON/OFF of the raw data storing before formatting.
{CORR COEF ON/OFF}	:	Selects ON/OFF of the calibration data storing. When the calibration is performed, ON is automatically selected.
{DATA ARRAY ON/OFF}	:	Selects ON/OFF of the formatted data storing.
{MEM ARRAY ON/OFF}	:	Selects ON/OFF of the memory data storing.

7.14.4 Setting Register Name

The register name is used so that it can be searched easily. When recalling, the register is called as the named register set.

The setting and the explanation

① Press the **[SAVE]** to call the save menu. (Refer to senction A.4.)

② Press the *{SAVE REGISTER}* to call the save register menu.

③ Press the *{RENAME REG}* to display the label window and calls the name editing menu.

④ Name editing menu

{EDIT NAME} : Displays the label window (Figure 7-19) and calls the character editing menu. (See step ⑤.)

{CURSOR ↑} :
{CURSOR ↓} : Shifts the cursor up/down of the register list (Figure 7-20). The register name of the cursor position can be edited.

⑤ Character editing menu

{DONE} : Completes editing.
{CURSOR →} : Shifts the label cursor right.
{CURSOR ←} : Shifts the label cursor left.
{BACKSPACE} : Executes the back space operation.
{DELETE CHAR} : Deletes the character of the cursor position.
{CLEAR NAME} : Clears all the characters (names).
{CANCEL} : Cancels editing.

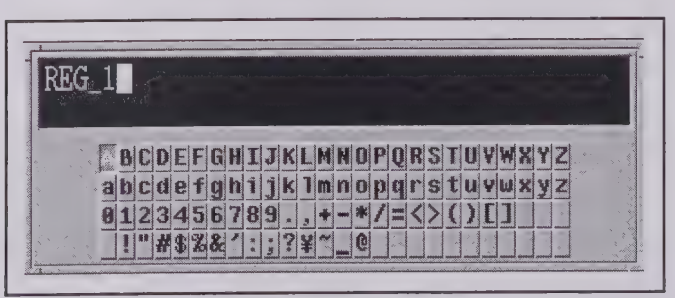


Figure 7-19 Label Window Display

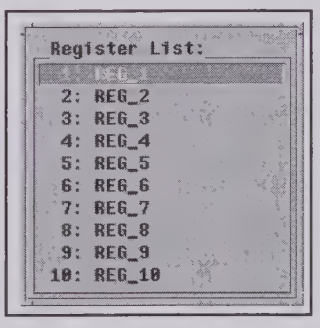


Figure 7-20 Register List Display

CAUTION!
The setting of register name is effective only for the saved register.
If the name is set to the unsaved register and the power source is switched off without executing the saving, the set register name is not saved.

7.14.5 Setting File Name

The file name is used for searching so that it can be searched easily. When recalling, the file is called as the named file set.

The setting and the explanation

① Press the **[SAVE]** to call the save menu. (Refer to section A.4.)

② Press the *{STORE FILE}* to call the store file menu.

③ Press the*{NAME↑}*, *{NAME↓}* to select a desired file name.

④ Press the *{EDIT NAME}* to display the label window (Figure 7-19) and calls the character editing menu.

⑤ Character menu

{DONE}	:	Completes editing.
{CURSOR →}	:	Shifts the label cursor right.
{CURSOR ←}	:	Shifts the label cursor left.
{BACKSPACE}	:	Executes the back space operation.
{DELETE CHAR}	:	Deletes the character of the cursor position.
{CLEAR NAME}	:	Clears all the characters (names).
{CANCEL}	:	Cancels editing.

CAUTION!
The setting of file name is effective only for the stored file.
If the name is set to the unstored file and the power source is switched off without executing the store, the set file name is not stored.

7.14.6 Clearing Saved Register

Clears registers.

When the register name is defined, the defined register name is displayed on the menu.

The setting and the explanation

① Press the **[SAVE]** to call the save menu. (Refer to section A.4.)

② Press the *{CLEAR REGISTER}* to call the clear register menu.

③ Clear register menu

- Clear register menu (1 of 4)

  {CLEAR REG-1} : Clears the register 1.
  {CLEAR REG-2} : Clears the register 2.
  {CLEAR REG-3} : Clears the register 3.
  {CLEAR REG-4} : Clears the register 4.
  {CLEAR REG-5} : Clears the register 5.

- Clear register menu (2 of 4)

  {CLEAR REG-6} : Clears the register 6.
  {CLEAR REG-7} : Clears the register 7.
  {CLEAR REG-8} : Clears the register 8.
  {CLEAR REG-9} : Clears the register 9.
  {CLEAR REG-10} : Clears the register 10.

- Clear register menu (3 of 4)

  {CLEAR REG-11} : Clears the register 11.
  {CLEAR REG-12} : Clears the register 12.
  {CLEAR REG-13} : Clears the register 13.
  {CLEAR REG-14} : Clears the register 14.
  {CLEAR REG-15} : Clears the register 15.

- Clear register menu (4 of 4)

  {CLEAR REG-16} : Clears the register 16.
  {CLEAR REG-17} : Clears the register 17.
  {CLEAR REG-18} : Clears the register 18.
  {CLEAR REG-19} : Clears the register 19.
  {CLEAR REG-20} : Clears the register 20.

7.14.7 Purging Stored File

Purges files.

When the file name is defined, the defined file name is displayed on the menu.

The setting and the explanation

① Press the **[SAVE]** to call the save menu. (Refer to section A.4.)

② Press the *{PURGE FILE}* to call the purge file menu.

③ Purges files menu

{PURGE} : Purges the file.

{CURSOR ↑} :
{CURSOR ↓} : Shifts the cursor up/down of file list.

* The file of the cursor position can be purged.

7.14.8 Executing Recall

Recalls register or file.

When the register/file name is defined, the defined name is displayed on the menu.

The setting and the explanation

① Press the **[RECALL]** to call the recall menu. (Refer to section A.4.)

② Recall menu

- Recall menu (1 of 4)

{RECALL REG-1} : Recalls the setting data, calibration data and memory trace data saved in the register 1.

{RECALL REG-2} : Recalls the setting data, calibration data and memory trace data saved in the register 2.

{RECALL REG-3} : Recalls the setting data, calibration data and memory trace data saved in the register 3.

{RECALL REG-4} : Recalls the setting data, calibration data and memory trace data saved in the register 4.

{RECALL REG-5} : Recalls the setting data, calibration data and memory trace data saved in the register 5.

{RECALL POWER OFF}
: The settings are stored automatically when the power of the R3765/67H series is turned off. When the power is turned on again, the data is set to the initial state. By pressing this key, the stored data is read again.

{LOAD FILE} : Calls the load file menu used to load the all informations stored in the file. (See step ③ and Figure 7-18.)

Note: ***Before LOAD FILE is executed, be sure to insert a formatted floppy disk to the drive.***

- Recall menu (2 of 4)

  {RECALL REG-6} : Recalls the setting data, calibration data and memory trace data saved in the register 6.

  {RECALL REG-7} : Recalls the setting data, calibration data and memory trace data saved in the register 7.

  {RECALL REG-8} : Recalls the setting data, calibration data and memory trace data saved in the register 8.

  {RECALL REG-9} : Recalls the setting data, calibration data and memory trace data saved in the register 9.

  {RECALL REG-10} : Recalls the setting data, calibration data and memory trace data saved in the register 10.

  {RECALL POWER OFF}
  : The settings are stored automatically when the power is turned off. When the power is turned on again, the data is set to the initial state. By pressing this key, the stored data is read again.

  {LOAD FILE} : Calls the load file menu used to load the all informations stored in the file. (See step ③ and Figure 7-18.)

- Recall menu (3 of 4)

  {RECALL REG-11} : Recalls the setting data, calibration data and memory trace data saved in the register 11.

  {RECALL REG-12} : Recalls the setting data, calibration data and memory trace data saved in the register 12.

  {RECALL REG-13} : Recalls the setting data, calibration data and memory trace data saved in the register 13.

  {RECALL REG-14} : Recalls the setting data, calibration data and memory trace data saved in the register 14.

  {RECALL REG-15} : Recalls the setting data, calibration data and memory trace data saved in the register 15.

  {RECALL POWER OFF}
  : The settings are stored automatically when the power is turned off. When the power is turned on again, the data is set to the initial state. By pressing this key, the stored data is read again.

  {LOAD FILE} : Calls the load file menu used to load the all informations stored in the file. (See step ③ or Figure 7-18.)

- Recall menu (4 of 4)

{RECALL REG-16} : Recalls the setting data, calibration data and memory trace data saved in the register 16.

{RECALL REG-17} : Recalls the setting data, calibration data and memory trace data saved in the register 17.

{RECALL REG-18} : Recalls the setting data, calibration data and memory trace data saved in the register 18.

{RECALL REG-19} : Recalls the setting data, calibration data and memory trace data saved in the register 19.

{RECALL REG-20} : Recalls the setting data, calibration data and memory trace data saved in the register 20.

{RECALL POWER OFF}
: The settings are stored automatically when the power is turned off. When the power is turned on again, the data is set to the initial state. By pressing this key, the stored data is read again.

{LOAD FILE} : Calls the load file menu used to load the all informations stored in the file. (See step ③ or Figure 7-18.)

③ Load file menu

{LOAD} : Loads all informations stored in the file.

{CURSOR↑} :
{CURSOR↓} :] Shifts the cursor up/down of file list.

Note: The file of the cursor position can be recalled.

{Return} : Makes the control return to the recall menu.

Note: If a file stored with RAW ARRAY or DATA ARRAY ON is loaded, the sweep becames HOLD without reservation.

7.15 Hard Copy

Screen data can be output to a plotter or printer.
The data is output to the plotter through the GPIB interface or saved to a floppy disk as an HPGL file.
Data is output to the printer through the PRINTER port (Centronics-compatible interface).
In addition, the data can be output to the floppy disk as a bitmap file.

To use the GPIB, set the instrument to the system controller using the GPIB block, then set the GPIB address for the plotter. (Refer to Section 7.11.2.)

Operation procedure

① Press the **[COPY]** to call the copy menu. (Refer to section A.4.)

② Copy menu

{PRINT}	:	Executes hard copy to the printer.
{PLOT}	:	Outputs hard copy to the plotter or outputs an HPGL file. (Note)
{SELECT QUADRANT}	:	Calls the plot scale menu used to select the size and location of the hard copy. (See step ③ of sub-section 7.15.1.)
{DEFINE PLOT}	:	Calls the plot data menu used to define the items for hard copy operation. (See step ③ of sub-section 7.15.2.)
{CONFIGURE PLOT}	:	Calls the plotter pen menu used to select pen number and data-line type to be used. (See step ③ of sub-section 7.15.3.)
{PRINT/PLOT SETUP}	:	Calls the setup menu used to set up the setting of printer or plotter. (See step ③ of sub-section 7.15.5.)
{BITMAP FILE}		Calls the bitmap file menu. (Refer to Section 7.15.6.)

Note: ***In using the plotter of HP company, the indication of the error such as error lamp lighting will be occasionally done.***

7.15.1 Setting Plot Scale

Specifies the output position and the size for plotting on A4 size paper.

The setting and the explanation

① Press the **[COPY]** to call the copy menu. (Refer to section A.4.)

② Press the *{SELECT QUADRANT}* to call the plot scale menu.

③ Plot scale menu

{FULL PAGE} : Selects the plot scale to output one data on A4 size paper with full page.

{LEFT} : Selects the plot scale to output data to the left position by dividing A4 size paper into two blocks.

{RIGHT} : Selects the plot scale to output data to the right position by dividing A4 size paper into two blocks.

{LEFT UPPER} : Selects the plot scale to output data to upper left position by dividing A4 size paper into four blocks.

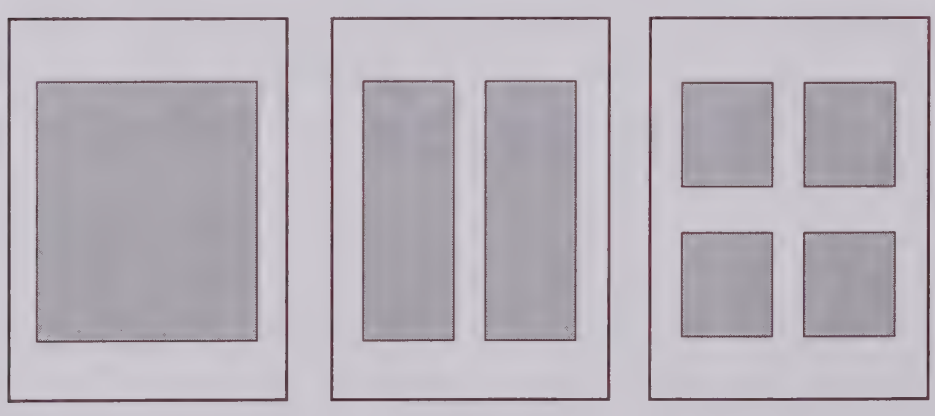
{LEFT LOWER} : Selects the plot scale to output data to lower left position by dividing A4 size paper into four blocks.

{RIGHT UPPER} : Selects the plot scale to output data to upper right position by dividing A4 size paper into four blocks.

{RIGHT LOWER} : Selects the plot scale to output data to lower right position by dividing A4 size paper into four blocks.

(Hard copy example)

Full page | Divided into 2 blocks | Divided into 4 blocks



7.15.2 Selecting Plot Data

Selects items to be hard-copied.

Since the items to be set in this menu are independent to the channels, they are set to the active channel only.

The setting and the explanation

① Press the **[COPY]** to call the copy menu. (Refer to section A.4.)

② Press the *{DEFINE PLOT}* to call the plot data menu.

③ Plot data menu

{PLOT DATA ON/OFF} : Sets ON/OFF of the measurement data output.
{PLOT MEMORY ON/OFF} : Sets ON/OFF of the memory data output.
{PLOT GRATICULE ON/OFF}: Sets ON/OFF of the coordinate output.
{PLOT TEXT ON/OFF} : Sets ON/OFF of the text data output.
{PLOT MARKER ON/OFF} : Sets ON/OFF of the marker data output.
{PLOT REF LINE ON/OFF} : Sets ON/OFF of the reference line output.

Note: ***When both the text data output and the marker data output are set to ON, the output of the marker list and filter analysis result is also set.***

7.15.3 Specifying Pen

Selects the pen number and line type to be used.

The setting and the explanation

① Press the **[COPY]** to call the copy menu. (Refer to section A.4.)

② Press the *{CONFIGURE PLOT}* to call the plotter pen menu.

③ Plotter pen menu

{PEN NUM DATA} : Specifies the pen number of the measurement data.
{PEN NUM MEMORY} : Specifies the pen number of the memory data.
{PEN NUM GRATICULE} : Specifies the pen number of the coordinate data.
{PEN NUM TEXT} : Specifies the pen number of the text data.
{PEN NUM MARKER} : Specifies the pen number of the marker data.
{LINE TYPE DATA} : Selects the line type of the measurement data.
{LINE TYPE MEMORY} : Selects the line type of the memory data.

- The selection of the line type is as follows.
  0 ; Solid line
  1 ; Dotted line
  2 ; Dashed line
  3 ; Chain line

7.15.4 Plotter Setup

The setting and the explanation

① Press the **[COPY]** to call the copy menu. (Refer to section A.4.)

② Press the *{PRINT/PLOT SETUPS}* to call the setup menu.

③ Setup menu

{PRINTER} : Calls the printer setting menu. (Refer to sub-section 7.15.5.)

{PRINT SPEED FAST/SLOW}
: Selects FAST/SLOW of printer speed. (Refer to sub-section 7.15.5.)

{PLOT LABEL ON/OFF} : Selects ON/OFF of the label and real-time clock output.

{PLOT P.TXT ON/OFF} : Sets ON/OFF of output of the characters which have been written on the screen using the controller function.

{DEFAULT SETUPS} : Returns all the copy menu to the initial settings.

{PLOTTER} : Calls the plotter selection menu.

Note: ***In using the plotter of HP company, the indication of the error such as error lamp lighting will be occasionally done.***

④ Plotter selection menu

{AT} : Selects the AT plotter as the output device.

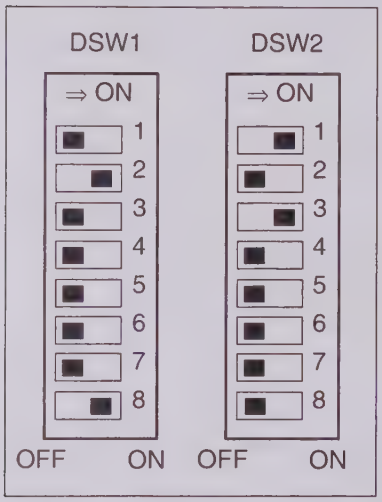
{HP} : Selects the HP plotter as the output device.

{HPGL FILE} : Selects the floppy disk device as the output device. The output is then saved as an HPGL (Hewlett Packard Graphics Language) file.

File name: plotxxx.hgl
(<xxx> is a three-digit integer)
Note that xxx is reset to 000 when the network analyzer power is turned on, and this number is incremented by 1 each time file data is saved.
If there are two files with the same name, the count is incremented by one, and the file is saved with a different file name.

⑤ Setting R9833 DIP switches

The DIP switches should be set to the standard values as shown in Figure 7-21. These switched are used to set the initial conditions at powering on and the interface conditions.



DSW1 :
HP mode when SW No.8 is ON.
FP-GL mode when SW No.8 is OFF.
In AT mode, it is required to set OFF SW No.8 and ON SW No.4. (Refer to Table 7-3.)

DSW2 :
Sets the plotter address to 5. (Refer to Table 7-4.)

Figure 7-21 Setting DIP Switches

Table 7-3 DSW1 Function

<table>
<tr><th>SW No.</th><th>Functions (ON = 1)</th><th>Standards</th></tr>
<tr><td>1 to 3</td><td>Paper size setting (SW3 = 0) (SW3 = 1)
<table>
<tr><th>SW1</th><th>SW2</th><th>ISO/JIS</th><th>ANSI</th></tr>
<tr><td>0</td><td>0</td><td>A3 maximum width and depth</td><td>B maximum width and depth</td></tr>
<tr><td>1</td><td>0</td><td>A3 long vertical way direction filling up</td><td>B long vertical way direction filling up</td></tr>
<tr><td>0</td><td>1</td><td>A4 long side way direction filling up</td><td>A long side way direction filling up</td></tr>
<tr><td>1</td><td>1</td><td>A4 long vertical way direction filling up</td><td>A long vertical way direction filling up</td></tr>
</table></td><td>SW1 = 0
SW2 = 1
SW3 = 0

A4 long side way</td></tr>
<tr><td>4</td><td>Setting rotational coordinates 1 : rotational coordinates ON</td><td>0</td></tr>
<tr><td>5</td><td>Selection of unit length for step number 0 : normal 1 : switch</td><td>0</td></tr>
<tr><td>6</td><td>Paper detection disable 0 : with paper detection function
1 : not with paper detection function</td><td>0</td></tr>
<tr><td>7</td><td>Switching input buffer capacity 1 : maximum (12KB) 0 : 1KB</td><td>0</td></tr>
<tr><td>8</td><td>FP-GL-I/FP-GL-II select 1 : FP-GL-I 0 : FP-GL-II</td><td>1</td></tr>
</table>

Table 7-4 DSW2 Function

SW No.	Functions (ON = 1)	Standards
1 to 5	Plotter addresssetup: Defines the device address with all bits. Bit structure SW5 | SW4 | SW3 | SW2 | SW1 Address 31 is for listen only mode.	SW1 = 1 SW2 = 1 SW3 = 1 SW4 = 1 SW5 = 1
6	Selection of EOI signal control 0 : EOI disabled 1 : EOI enabled However, available only when using FP-GL-II. Not defined for FP-GL-I.	0
7	Not defined	0
8	Selection of reduced drawing mode (only when using FP-GL-II). 1 : Selects reduced drawing mode (0.9 time)	0

If EOI signal is set to ON (enable) and EOI terminal receives "L" when using FP-GL-II, the plotter operates in the same manner as the terminator.
When the plotter sends data, EOI terminal is set to "L" at the same time as it outputs the last "LF" code of sending data.
If the reduced drawing mode is selected when using FP-GL-II, the plotter outputs the drawing being reduced to 0.9 time, based on the global origin.
Then, the actual size of the valid drawing range is not changed and the range to be specified by the program is extended.

7.15.5 Printer Setup

Setting a printer.

Operation procedure

① Press **[COPY]** to call the copy menu.

② Press *{PRINT/PLOT SETUPS}* to call the setup menu.

③ Setup menu

{PRINTER SETUP} : Calls the printer setup menu. (See step ④.)

{PRINT SPEED FAST/SLOW}
: Sets the print mode to FAST or SLOW. To set other parameters, use the printer setup menu (④).

{PLOT LABEL ON/OFF} : See section 7.15.4. (This menu is for the printer. This menu is not used at printer setup.)

{PLOT P.TXT ON/OFF} : See section 7.15.4. (This menu is for the printer. This menu is not used at printer setup.)

{DEFAULT SETUPS} : See section 7.15.4. (This menu is for the printer. This menu is not used at printer setup.)

{PLOTTER} : See section 7.15.4. (This menu is for the printer. This menu is not used at printer setup.)

④ Printer setup menu

{DPI} : Sets the print resolution.

{UPPER MARGIN} : Sets the upper margin in millimeters.

{LEFT MARGIN} : Sets the left margin in millimeters.

{ZOOM SCALE} : Specifies the enlargement ratio. Select it from either one, two or three times.

{LANDSCAPE ON/OFF} : Specifies the print direction (vertical or horizontal writings).

{FORMFEED ON/OFF} : Toggles the formfeed ON or OFF.

{PRINTER} : Calls the printer menu. (See step ⑤.)

⑤ Printer menu

{ESC/P J84} : Selects a printer which supports the printer control code EPSON ESC/P J83 or J84 of the Seiko-Epson's 24-dot printer.

{ESC/P V.2} : Selects a printer which supports the printer control code EPSON ESC/P V.2 used for the Seiko-Epson's 24/48-dot printer. If a printer which supports only the raster mode is used, select this menu.

{PCL} : Selects a printer (compatible with LaserJet 5L) which supports the Hewlett Packard printer control code PCL.

{PRINT COLOR ON/OFF} : Selects the color or monochrome output mode.

7.15.6 Bitmap File Setup

Setting a bitmap file.

Operation procedure

① Press **[COPY]** to call the copy menu.

② Press *{BITMAP FILE}* to call the bitmap file menu.

③ Bitmap file menu

{SAVE TO DISK} : Saves bitmap files to the disk.

{COMPRESSION ON/OFF}
: Toggles the bitmap file compression ON or OFF.

{TRUNCATE ON/OFF}
: When there is more than one file with the same name, this determines whether the older file is overwritten or saved with a different name.
File name: printxxx.bmp
(<xxx> is a three-digit integer)
<xxx> is set to 000 at power-up time, then incremented each time the data is saved.
When TRUNCATE is turned OFF, a file with the same name as another file is saved with a different name after the counter has been updated.

7.16 Communication with Peripheral Devices

As standard, the R3765/67G series is equipped with the parallel I/O interface and RS-232 interface as well as the GPIB interface. With these interfaces, it can communicate with peripherals.

- Parallel I/O : Used for communication with peripheral devices such as a handler.
- RS-232 : Used for output of screen hard copy or print from BASIC by connecting to the printer. (Refer to section 7.15 and sub-section 7.16.2.)

7.16.1 Parallel I/O Port

(1) Outline

The parallel I/O port is the input/output port to communicate with a handler or peripherals. Use always the shield cable for the connection.
The parallel I/O connector on the back panel is used for communication.
Figure 7-23 shows the internal pin assignment and signals of the connector.
These I/O port is controlled with ENTER and OUTPUT commands.

- Input/output port
  There are two output ports and two input/output ports, as follows:
  Port only for output : A port ; 8-bit width
  B port ; 8-bit width
  Input/output port : C port ; 4-bit width
  D port ; 4-bit width
- Port C status output, port D status output
  Shows the settings of the input of the input/output ports C and D. It is low when C or D port is set to input, it is high when it is set to output.
- Write strobe output for output port
  By generating a negative pulse on the write strobe output, it shows a data is output to some port.

  Figure below shows the timing chart of the write strobe output and data output.

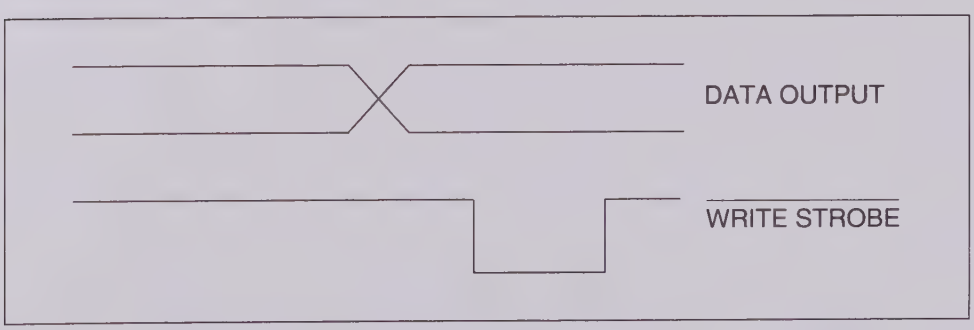
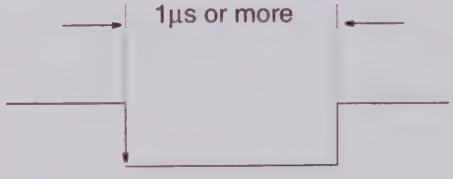


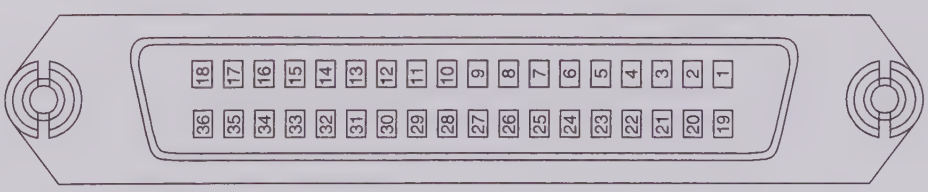
Figure 7-22 Timing Chart of WRITE STROBE

- INPUT 1
  By entering a negative pulse on the INPUT 1, the OUTPUT 1 and 2 are set to LOW. The pulse width of the input signal to be entered in the INPUT 1 should be more than 1μs.
- OUTPUT 1 and 2
  These two signal lines are the latch output terminals set to LOW when a negative pulse is entered on the INPUT 1. It can be set to LOW or HIGH with the BASIC command (OUTPUT).
- PASS/FAIL output
  Generates LOW when the result of the limit test is PASS and HIGH when the result is FAIL. This function is available only when the limit test function is ON.
- Write strobe output for PASS/FAIL output
  When the limit test result is output to the PASS/FAIL output line, generates a negative pulse.
- SWEEP END
  When the R3765/67G series finishes the sweeping, generates a negative pulse with a width of 10μs.
- +5V output
  +5V output is provided for the external device. The maximum current to be supplied is 100mA. A protection element is equipped on this line to shut off the over-current.
- EXT TRIG input
  By entering a negative pulse on this line, it is possible to trigger the sweep of measurement. The pulse width should be at least 1μs. The sweeping starts at the trailing edge of the pulse. When this signal line is used, the trigger mode should be set to external source.



(2) Parallel I/O connector pin assignment and signal standard

Pin No.	Signal name	Function
1	GND	Ground
2	INPUT 1	Negative logic pulse input of TTL level (width:1μs or more)
3	OUTPUT 1	Negative logic latch output of TTL level
4	OUTPUT 2	Negative logic latch output of TTL level
5	Output port A0	Negative logic latch output of TTL level
6	Output port A1	Negative logic latch output of TTL level
7	Output port A2	Negative logic latch output of TTL level
8	Output port A3	Negative logic latch output of TTL level
9	Output port A4	Negative logic latch output of TTL level
10	Output port A5	Negative logic latch output of TTL level
11	Output port A6	Negative logic latch output of TTL level
12	Output port A7	Negative logic latch output of TTL level
13	Output port B0	Negative logic latch output of TTL level
14	Output port B1	Negative logic latch output of TTL level
15	Output port B2	Negative logic latch output of TTL level
16	Output port B3	Negative logic latch output of TTL level
17	Output port B4	Negative logic latch output of TTL level
18	EXT TRIG	EXTERNAL TRIGGER input (width : 1μs or more), negative logic
19	Output port B5	Negative logic latch output of TTL level
20	Output port B6	Negative logic latch output of TTL level
21	Output port B7	Negative logic latch output of TTL level
22	Input/output port C0	Negative logic state input/latch output of TTL level
23	Input/output port C1	Negative logic state input/latch output of TTL level
24	Input/output port C2	Negative logic state input/latch output of TTL level
25	Input/output port C3	Negative logic state input/latch output of TTL level
26	Input/output port D0	Negative logic state input/latch output of TTL level
27	Input/output port D1	Negative logic state input/latch output of TTL level
28	Input/output port D2	Negative logic state input/latch output of TTL level
29	Input/output port D3	Negative logic state input/latch output of TTL level
30	Port C status	TTL level, Input mode: LOW, Output mode: HIGH
31	Port D status	TTL level, Input mode: LOW, Output mode: HIGH
32	Write strobe signal	TTL level, Negative logic, Pulse output
33	PASS/FAIL signal	TTL level, PASS: LOW, FAIL: HIGH, latch output
34	SWEEP END signal	TTL level , Negative logic, Pulse output (width:10μs or more)
35	+5V	+5V±10%, 100mA MAX
36	Write strobe signal (PASS/FAIL)	TTL level, Negative logic, Pulse output



When there's no connection, except for GND, they have high impedance.

Figure 7-23 Parallel I/O (36-pin) Connector Pin Assignment and Signal

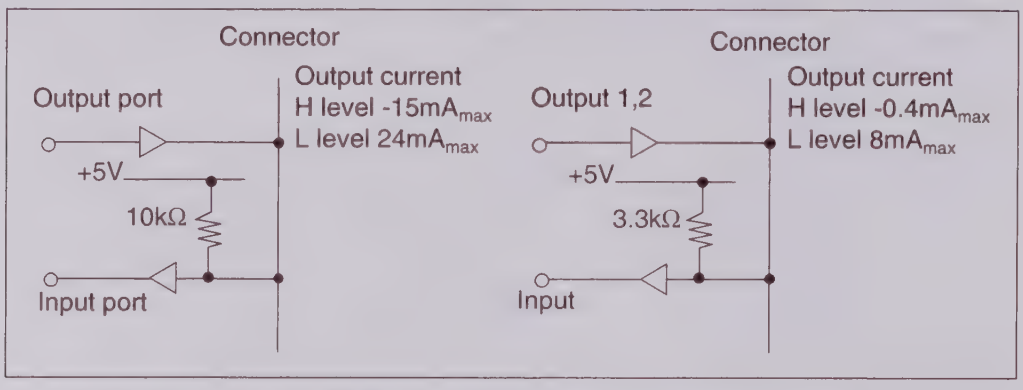


Figure 7-24 Schematic Circuit Diagram of Parallel I/O Port

(3) Mode setting of port

Command	Output port	Input port
OUTPUT 36 ; 16	A, B, C, D	
OUTPUT 36 ; 17	A, B, D	C
OUTPUT 36 ; 18	A, B, C	D
OUTPUT 36 ; 19	A, B	CD

To use a parallel I/O port, first set the mode setting of port. The combination of the setting command and the Input/Output port is referred the above table.

(Example)

```
10  OUTPUT  36;19
20  OUTPUT  33;255
30  ENTER   37;A
```

Set the output port for port A and port B, and the input port for port CD.

(4) Each port operation method

Describes the operation method by built-in BASIC.
OUTPUT statement (for output) and ENTER statement (for input) are used for data input/output.
In the BASIC command (OUTPUT and ENTER statements), each port is distinguished by the address used in the statement.

(a) BASIC format

```
OUTPUT (address)    ; (output data)
ENTER (address)     ; [variable]
                      (Input data are assigned to specified variable.)
```

(b) Address and data range

Address	Port to be used
33	Port A (Output only: OUTPUT statement only)
34	Port B (Output only: OUTPUT statement only)
35	Port C (Input/output : ENTER, OUTPUT)
36	Port D (Input/output : ENTER, OUTPUT)
37	Port CD (Input/output : ENTER, OUTPUT)

- OUTPUT 33, 34, 37
  OUTPUT × × ; 0 to 255 (8-bit)
- OUTPUT 35, 36
  OUTPUT × × ; 0 to 15 (4-bit)
  * The OUTPUT 35 concerns with the Set/Reset of Flip Flop.
- ENTER 35, 36
  ENTER × × ; numeric variable (4-bit) (Data from 0 to 15 are assigned.)
- ENTER 37
  ENTER 37 ; numeric variable (8-bit) (Data from 0 to 255 are assigned.)

(5) INPUT 1, OUTPUT 1 and OUTPUT 2 Terminals

By combining with the signal lines of INPUT 1, OUTPUT 1 and OUTPUT 2, convenient functions are provided to easily control external devices.

The functions are; function which sets two latch outputs of OUTPUTs 1 and 2 to LOW by pulse input to INPUT 1, and function which detects the state of OUTPUT 1 by INPUT 1.

Also, the state of OUTPUTs 1 and 2 can be controlled by OUTPUT command.

(a) Setting and Resetting of OUTPUT 1 and OUTPUT 2

The following four types are provided for set/reset as follows:

- Setting OUTPUT 1 : OUTPUT 35 ; 16
- Setting OUTPUT 2 : OUTPUT 35 ; 48
- Resetting OUTPUT 1 : OUTPUT 35 ; 80
- Resetting OUTPUT 2 : OUTPUT 35 ; 112

(b) INPUT 1 (external input)

The state of OUTPUT 1 can be observed by INPUT 1 using ENTER statement.

ENTER 34; (numeric variable)

If 1 is assigned to the numeric variable, OUTPUT 1 is ON (Low level: negative logic), if 0, OUTPUT 1 is OFF (High level).

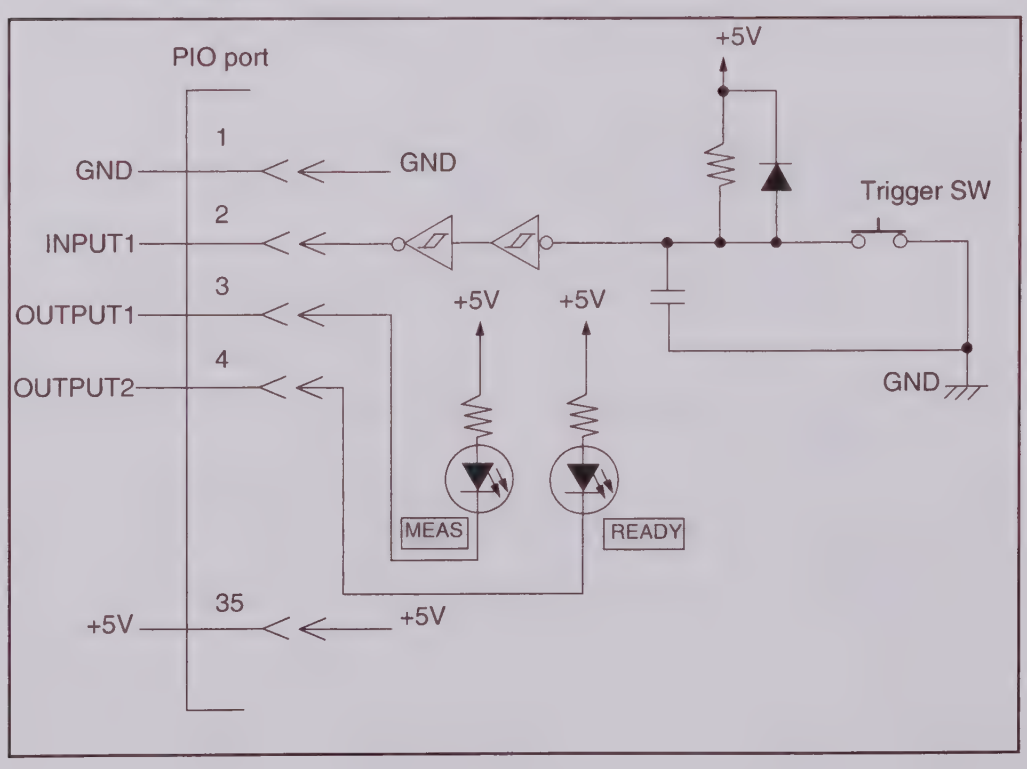
```
Example :  10  OUTPUT 36 ; 16
           20  ENTER 34 ; A
           30  IF A<> 1 THEN GOTO 20
           40  OUTPUT 33 ; 1
```

By observing the state of OUTPUT 1, if OUTPUT 1 is set to ON, then 1 is output to the port A.

① Examples of INPUT 1, OUTPUT 1 and OUTPUT 2

< When program is executed by trigger switch >

- Circuit example



- Program example

```
10    OUTPUT 35 ; 80
20    OUTPUT 35 ; 112
 :
 :
100   OUTPUT 35 ; 48
110   ENTER 34 ; A
120   IF A <> 1 THEN GOTO 110
130   OUTPUT 35 ; 112
 :
 :
500   OUTPUT 35 ; 80
510   GOTO 100
520   STOP
```

Waiting time for measurement: Represents **[READY]**.
During measurement operation: Represents **[MEAS]**.

[READY], **[MEAS]** turns OFF.

Network analyzer initial setup
[READY] turns ON.

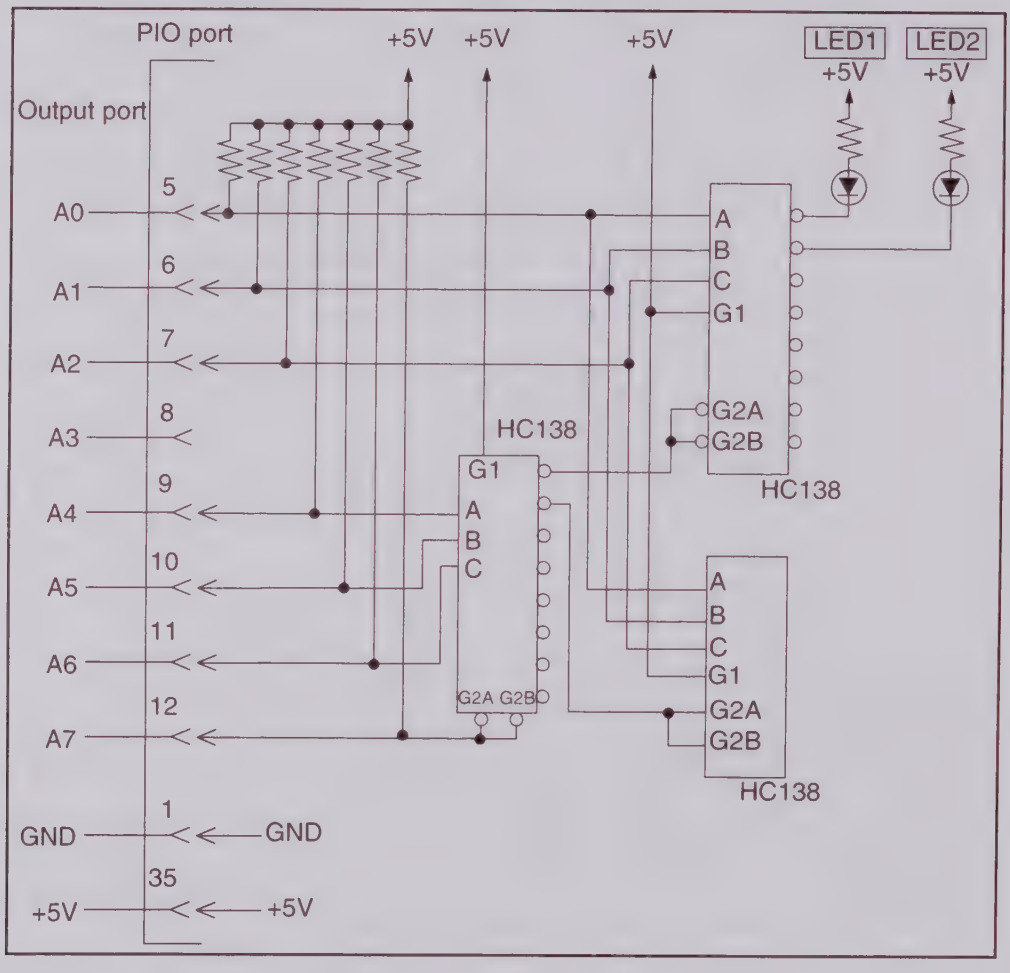
Recognition of Trigger SW
[READY] turns OFF.

Measurement routine
[MEAS] turns OFF.
When repeating the measurement

② Usage example of output ports A and B

< When LED is used for selecting devices (when port A is used) >

- Circuit example



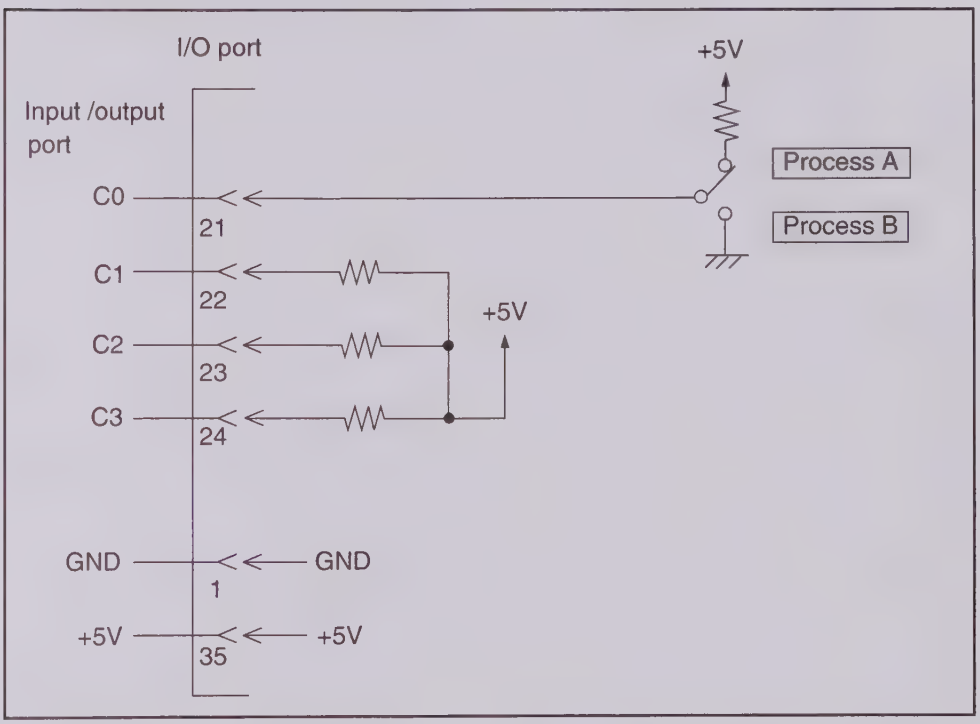
- Program example

```
 10   OUTPUT 36 ; 16      Defines ports A, B, C and D as output port.
 20   OUTPUT 33 ; 0       Initializes LED.
 30
  :                       Measurement and judgment <measurement
                          variable: A>
  :                       (Judgment range: JED0 to JED1, JED1 to JED2...)
500   IF A>=JED0 AND A<JED1 THEN OUTPUT 33 ; 0xFF
  :                       (When JED0 to JED1, lights up LED 1.)
510   F A>=JED1 AND A<JED2 THEN OUTPUT 33 ; 0xFE
  :                       (When JED1 to JED2, lights up LED 2.)
  :
800   GOTO 30
810   STOP
```

③ Usage example of input/output ports C and D

< Example to change routine whether bit-0 of I/O port C is 0 or 1 >

- Circuit example



- Program example (Check the port C by pressing "Trigger SW" in example ①.)

```
10   OUTPUT 36 ; 19                 Defines ports A and B as output port.
20   OUTPUT 35 ; 80                 Defines ports C and D as input port.
30   OUTPUT 35 ; 112
 :                                  Network analyzer initial setup
100  *TRIG
110  ENTER 34 ; A
120  IF A < > 1 THEN GOTO *TRIG
130  ENTER 35 ; B                   Obtains value of port C.
140  IF B = 1 THEN GOTO *ROUT_B
150  *ROUT_A
 :                                  Process A
490  GOTO *TRIG
500  *ROUT_B
 :                                  Process B
900  GOTO *TRIG
910  STOP
```

7.16.2 RS-232 Interface

The R3765/67G series is equipped with an RS-232 interface as a standard. Therefore, data such as measurement and analysis data can be output to an RS-232 printer.

The RS-232 interface defines mechanical and electrical characteristics of interface for connecting between data terminal and data communication device standardized by Electronic Industries Association (EIA).

Refer to "Regulation" for details.

(1) Connection connector and signal table

Connection connector : 29-pin D-sub connector (female type)
Signal table

Pin No.	Signal name	Description
1	CD	Carrier Detection
2	RxD	Receive Data
3	TxD	Transmit Data
4	DTR	Data Terminal Ready
5	SG	Signal Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	RI	Ring Indicators

(2) Printer output method

The LLIST or LPRINT command is used to output to the RS-232 printer by the R3765/67G series. The setting such as a baud rate is defined by the CONTROL command.
Refer to "Programming manual" for details.

LLIST : Outputs BASIC program to the printer.
LPRINT : Outputs the contents of character strings, numeric values and variables.
CONTROL : Sets the values such as a baud rate, character length and others.

The setup value on power-up is as follows.

Baud rate : 9600 baud
Character length : 8-bit
Parity : None
Stop bit : 1-bit

8 IN ABNORMALITIES

Read this chapter when the R3765/67G series becomes abnormal.

8.1 Inspection and Simple Troubleshooting

If the R3765/67G series becomes abnormal, check the following items before asking for repair. When the trouble cannot be resolved by the following countermeasures, contact a sales representative. The addresses and the phone numbers are mentioned at the end of this manual. The fare will be charged on the user even for a repair as shown in the table below.

Symptom	Assumed cause	Remedy
The power cannot be turned on.	Power cable is not surely inserted in the connector.	Turn the power switch OFF, and re-connect the power cable.
	Power fuse is blown.	Replace power fuse.
No trace appears on the screen.	BACK LIGHT is set to OFF.	Press the BACK LIGHT to switch ON.
	Input cable or connector is loose.	Re-connect the input cable or connector.
Does not sweep.	Setting of the trigger is SINGLE.	Set to CONTINUOUS.
The measured result is incorrect.	The calibration was not performed correctly.	Execute the calibration meeting the measurement.
Key does not work.	In GPIB remote control mode.	When a program is being executed, stop it and press LCL key.
Data cannot be read (recalled) from floppy disk.	Floppy disk defect.	Check operation with other floppy disk.
	FDD (Floppy disk drive) defect.	Ask ADVANTEST for repair.
	Not set to A:drive.	Set it to A:drive
Data cannot be recorded (saved) in floppy disk.	The floppy disk is not initialized.	Initialize the floppy disk.
	The write protect is enabled.	Release the write protect.
	Not set to A:drive.	Set it to A:drive.

8.2 Error Messages

This chapter explains the error messages displayed on the screen.

(1) Types of error message

① Hardware trouble (Refer to sub-section 8.2.1.)

② Notice of hardware information (Refer to sub-section 8.2.2.)

③ Operating error (Refer to sub-section 8.2.3.)

④ Warning of the change of internal setting and the like (Refer to sub-section 8.2.4.)

⑤ Notice of the completion of an operation, the operating state and the like (Refer to sub-section 8.2.5.)

(2) Error message display

- The message is displayed on the fixed position of the liquid crystal display. Therefore the message is overwritten and only the last message is displayed.
- The message does not disappear until some panel key is pressed. However, the messages in ① and ② disappear when the R3765/67G series is returned from the state.
- The messages of ④, ⑤ and ⑥ are not displayed during GPIB command operation (including BASIC).

(3) Error message, the cause and the solving method

Explains in the following error message table.

8.2.1 Hardware Trouble

Cooling Fan Stop.	Cooling fan stopped.
Please Power OFF.	Please power OFF.
Source Unlevel	The signal source is at low level.
Synthe Unlock	The internal reference frequency source is out of the phase-locked loop. <How to handle> Contact a sales representative

8.2.2 Notice of Hardware Information

Ach Overload Bch Overload Cch Overload (OPT11/OPT14)	Overlevel is input into A channel. Overlevel is input into B channel. Overlevel is input into C channel. <How to handle> Check the input signal level.
External Standard In. External Trigger Ignored.	An external reference signal has been input. An input external trigger was ignored. (That does not mean a prohibiting state.) <How to handle> An external trigger (PIO-18pin) has been input in a state of not waiting for the external trigger. The state of waiting for the external trigger is the state of waiting for sweep in the external trigger mode (that is, in a state that TRIGGER[CONT] or TRIGGER[SINGLE] on the panel). If next trigger pulse is input during a sweep in using an external trigger source, the above error occurs. Check the trigger setting and the specification of an external trigger signal.

8.2.3 Operating Error

Calibration aborted.	Memorizing calibration data was aborted. <How to handle> While calibration data is being memorized, if the setting is changed, the calibration is aborted. Do not change the setting until the calibration is finished. (Refer to sub-section 7.5.5 and 7.5.6.)
Calibration canceled !	The acquired calibration data was cleared because the sweeping conditions were changed during calibration operated. <How to handle> The sweeping conditions must not be changed to acquire more than two calibration data. Execute the calibration data acquisition from the first. (Refer to sub-section 7.5.5.)
Calibration data not found.	CORRECT ON was executed without memorized calibration data. <How to handle> Memorize the calibration data. (Refer to sub-section 7.5.5.)
Can't find plotter !!!	A plotter was not found in a plot output. <How to handle> The plotter is not connected or GPIB address of the plotter is not correct. (Refer to sub-section 7.13.2.)
Can't ... When CORRECT ON.	To memorize calibration data or to execute CLEAR CAL DATA was attempted in the state of CORRECT ON. <How to handle> Choose CORRECT OFF. (Refer to sub-section 7.5.10.)
Can't ... When PROG-SWEEP.	The operator attempted to change the setting of the number of points while in the program sweep. <How to handle> Specify a sweep type other than PROGRAM SWEEP and USER SWEEP. (Refer to section 7.9.)

Operating Error

Can't ... When Sub Trace ON.	The measurement format was to be set to two traces (LOGMAG &PHASE, LOGMAG&DELAY or LINMAG&PHASE) in the state that the InputMeas setting was S_{11}&S_{21} or S_{22}&S_{12}. <How to handle> When the InputMeas setting is S_{11}&S_{21} or S_{22}&S_{12}, the measurement format cannot be set to two traces (LOGMAG&PHASE, LOGMAG&DELAY or LINMAG&PHASE). Change the InputMeas. (Refer to sub-section 7.4.1 and 7.4.4.)
Can't ... When USER-SWEEP.	The operator attempted to change the setting of the number of points while in the user sweep. <How to handle> Specify a sweep type other than PROGRAM SWEEP and USER SWEEP. (Refer to section 7.9.)
Data and Coef not matched.	CORRECT ON was to be executed under a condition differing from the measurement condition under which the correction data was acquired. <How to handle> Specify the same measurement condition as the one under which the correction data was acquired. (Refer to sub-section 7.5.5 and 7.5.6.)
Data and Memory not matched.	Trace operation (DATA/MEM, etc.) or memory trace display (DISPLAY MEMORY, DISPLAY DATA/MEM) were to be executed under a condition differing from the measurement condition under which the memory trace was acquired. <How to handle> Specify the same measurement condition as the one under which the memory trace was acquired. (Refer to sub-section 7.4.4 and 7.4.6.)
Disk not found.	A floppy disk could not be found in one of the operations LOAD FILE, STORE FILE or PORGE FILE of the R3765/67G series. <How to handle> ① The floppy disk has some scratches. ② It's not formatted. ③ It's not inserted in the drive. Check the floppy disk. (Refer to section 6.3, sub-section 7.11.1, 7.13.1, 7.14.3 and 7.14.8.)

Operating Error

Duplicate name.	The name that has previously been edited or reserved is input during *{EDIT NAME}* operation. <How to handle> Input a different name. (Refer to sub-section 7.14.1, 7.14.3, 7.14.4 and 7.14.5.)
File load error.	An error occurred in a *{LOAD FILE}* execution. <How to handle> Something is wrong with the floppy disk, or a file other than files stored in the R3765/67G series was specified. Check the floppy disk. (Refer to sub-section 7.14.8.)
File store error.	An error occurred in a *{STORE FILE}* execution. <How to handle> ① It's not formatted. ② It's in the state of write protection. Check the floppy disk. (Refer to sub-section 7.14.3.)
Formatting failure.	Something was wrong in the formatting operation. <How to handle> ① The floppy disk has some scratched. ② It's in the state of write protection. Check the floppy disk. (Refer to section 7.14.)
Illegal PROG-SWEEP points.	With the number of total points of all segments being less than 3 or more than 1201, the program sweep was specified. <How to handle> Specify the number of the segment point again. (Refer to sub-section 7.9.2.)
Illegal USER-SWEEP points.	With the number of total points of all segments being less than 3 or more than 1201, the user frequency sweep was specified. <How to handle> Specify the number of the segment point again. (Refer to sub-section 7.9.2.)

Operating Error

Memory not found.	A trace operation (DATA/MEM, etc.) or a memory trace display (DISPLAY MEMORY, DISPLAY DATA&MEM) was specified, with a memory trace not stored. <How to handle> Obtain the memory trace. (Refer to sub-section 7.4.4 and 7.4.7.)
None Controller	A plot output was specified not in system controller mode. <How to handle> Set to the system controller mode. (Refer to sub-section 7.13.2.)
Outside calibration range	Outside the calibration range The sweep range is set outside the calibration range. <How to handle> The calibration data cannot be used because the setting conditions are different from those used when the calibration data was acquired. Set the sweep range to a range where the sweep can be calibrated, or obtain the calibration data again (refer to Section 7.5).
Please set 1-trace FORMAT.	With the measurement format two traces (LOGMAG&PHASE, LOGMAG&DELAY, LOGMAG&PHASE), the memory trace display (DISPLAY MEMORY, DISPLAY DATA&MEM) was specified. <How to handle> The memory trace display is invalid with the measurement format two traces. Set the measurement format to one trace (other than LOGMAG&PHASE, LOGMAG&DELAY or LOGMAG&PHASE). (Refer to sub-section 7.4.2 and 7.4.4.)
Register recall error.	An error occurred in recalling a register. <How to handle> ① An unsaved register was specified. ② The register was damaged. Clear the register with CLEAR REG and save it again. (Refer to sub-section 7.14.1.)

Operating Error

Register save error.	An error occurred in saving a register. <How to handle> Available space is not in C: drive. Delete unnecessary files. (Refer to section 7.14.)
Segment #x error.	The PROGRAM SWEEP or USER SWEEP was specified in a state that STOP FREQ of the Xth segment is higher than START FREQ of the following segment. <How to handle> Specify the frequency of the Xth segment again. (Refer to sub-section 7.9.2 and 7.9.3.)
Segment not entered.	The PROGRAM SWEEP or USER SWEEP was specified without setting any segment. <How to handle> Specify the segment. (Refer to sub-section 7.9.2 and 7.9.3.)
Some STD not memorized.	To execute the DONE operation was attempted without obtaining all related calibration data. <How to handle> Obtain all calibration data (OPEN, SHORT, LOAD). (Refer to sub-section 7.5.5.)

8.2.4 Warning of Internal Set, Change, etc.

STIMURUS changed.	By the CORRECT ON setting, STIMULUS set value was changed internally to the one at the time the calibration acquired. However, only when INTERPORATE OFF setting. (Refer to section 7.3)
CORRECT turned off.	The CORRECT setting was internally altered to OFF. <How to handle> The measuring condition in which the correction data was obtained must be the same as the current measuring condition in the correcting measurement (CORRECT ON). Therefore, when the number of points or a sweep type is altered in a state of CORRECT ON, this message is displayed and CORRECT OFF is set. (Refer to sub-section 7.5.5.)
Not enough space.	Data could not be saved during the save register operation or STORE-FILE. <How to handle> ① Save register operation Data is saved in the drive C. If available space is not in the drive, this message is displayed. (However, the setting condition in this case is saved.) ② STORE-FILE. Available space is not in A:drive (floppy disk). Clear unnecessary files or use another floppy disk. (Refer to sub-section 7.14.7.)

Warning of Internal Set, Change, etc.

Display Mode changed.	The display mode setting was internally altered to DISPLYA DATA. <How to handle> In the memory trace display (DISPLAY MEMORY,DISPLAY DATA&MEM), the measuring condition under which the memory trace was acquired must be the same as the current measuring condition and the measuring format must be set to one trace. Therefore, when the number of points or the sweep type is altered in a state that the memory trace is displayed, or when the measuring format is set to two traces (LOGMAG&PHASE, LOGMAG&DELAY or LINMAG&PHASE), this message is displayed and the display mode is altered to DISPLAY DATA internally. (Refer to sub-section 7.4.4.)
Sweep time increased.	The setting of the sweep time was internally altered and the sweep time was increased. <How to handle> The minimum setting value of the sweep time is decided according to the RBW setting, etc. When the sweep time is set to AUTO, this message is not displayed. Therefore, when the sweep time is not set to AUTO, if this message is displayed by altering the setting of the RBW or and the sweep time is increased. Afterward, even if the RBW setting is set to the previous setting, the sweep time setting do not be set back to the previous setting. (Refer to sub-section 7.9.3.)
Trace-Math turned off.	The setting of the trace operation (DATA+MEM and others) was internally altered to OFF. <How to handle> The measuring condition in which the memory trace was obtained must be the same as the current measuring condition in the trace operation. Therefore, when the number of points or the sweep type was altered with the trace operation executed, this message is displayed and the trace operation is set to OFF. (Refer to sub-section 7.4.7.)

Warning of Internal Set, Change, etc.

FORMAT changed.	Setting of the measurement format is changed internally (to LOGMAG). <How to handle> When the setting of InputMeas is S_{11}&S_{21} or S_{22}&S_{12}, the measurement format cannot be set to 2 traces (LOGMAG& PHASE, LOGMAG&DELAY or LINMAG&PHASE). Therefore, when the measurement format is in the state of 2 traces and furthermore InputMeas is set to S_{11}&S_{21} or S_{22}&S_{12}, this message is displayed and the measuring format is changed to LOGMAG internally. (Refer to sub-section 7.4.1 and 7.4.4.)
Z0 VALUE changed.	Setting of Z_0 VALUE is changed internally. <How to handle> Changing the setting of CAL KIT is interlocked to the setting of Z_0 VALUE. For N (50Ω) or 3.5mm, 50Ω For N (75Ω), 75Ω. (Refer to sub-section 7.5.7 and section A.4.)
Disk not enough space	The bitmap file could not be saved. <How to handle> There is not sufficient space in the A:drive (floppy disk) for new files. Clear unnecessary files or use another floppy disk.

8.2.5 Completed Operation Conditions Messages

Clear Completed.	The memorized calibration data was cleared with CLEAR CAL DATA.
Formatting now ...	The floppy disk is now under formatting.
Formatting completed.	Formatting the floppy disk was correctly complete.
Store completed.	A trace data was copied into a memory trace with *{DATA → MEMORY}*.
Wait for sweep.	A sweep is being executed to obtain the calibration data.
Please wait, STORING FILE ...	STORE FILE is in execution.
Please wait, LOADING FILE ...	LOAD FILE is in execution.
Please wait, PURGING FILE ...	PURGE FILE is in execution.
STORE FILE completed !	STORE FILE completed normally.
LOAD FILE completed !	LOAD FILE completed normally.
PURGE FILE completed !	PURGE FILE completed normally.

9 PRINCIPLE

This chapter explains about the basic operation of the R3765/67G series in flow charts.

9.1 Principle

(1) Signal source block

R3765G series output the total output signal of 300kHz to 3.8GHz from 4.44GHz to 8.2GHz synthesizer and 4.4GHz fixed- signal generator.

R3767G series output the total output signal of 300kHz to 3.8GHz from 4.44GHz to 8.2GHz synthesizer and 4.4GHz fixed-signal generator, and the output signal of 3.8GHz to 8.0GHz from the synthesizer directly.

(2) Test-set section

For the AG type, TEST PORT is directly connected to the signal source and receiver parts.
For the BG type, TEST PORT1 is equipped with a directional bridge. The output from the signal source part is input to the directional bridge, and the output from the directional bridge is output to the receiver part.
TEST PORT 2 is directly connected to the receiver part.
For the CG type, TEST PORT1 and TEST PORT2 each are equipped with a directional bridge. The output from the signal source part is switched between TEST PORT1 and TEST PORT2 directional bridges. Each output from the directional bridge is input to the receiver part.

(3) Receiver block

① The input signal of 300kHz to 3.8GHz (for R3767G series, to 8.0GHz) is converted to 840kHz IF signal with the Sampler and input into the Mixer.

② 1st IF signal is converted to 40kHz 2nd IF signal with the Mixer and output to A/D circuit.

③ A/D processed data is performed high speed arithmetic processing with digital signal processor (DSP) and displayed in the display section.

9.2 Data Flow

The signal input into the receiver section is processed according to the following flow.

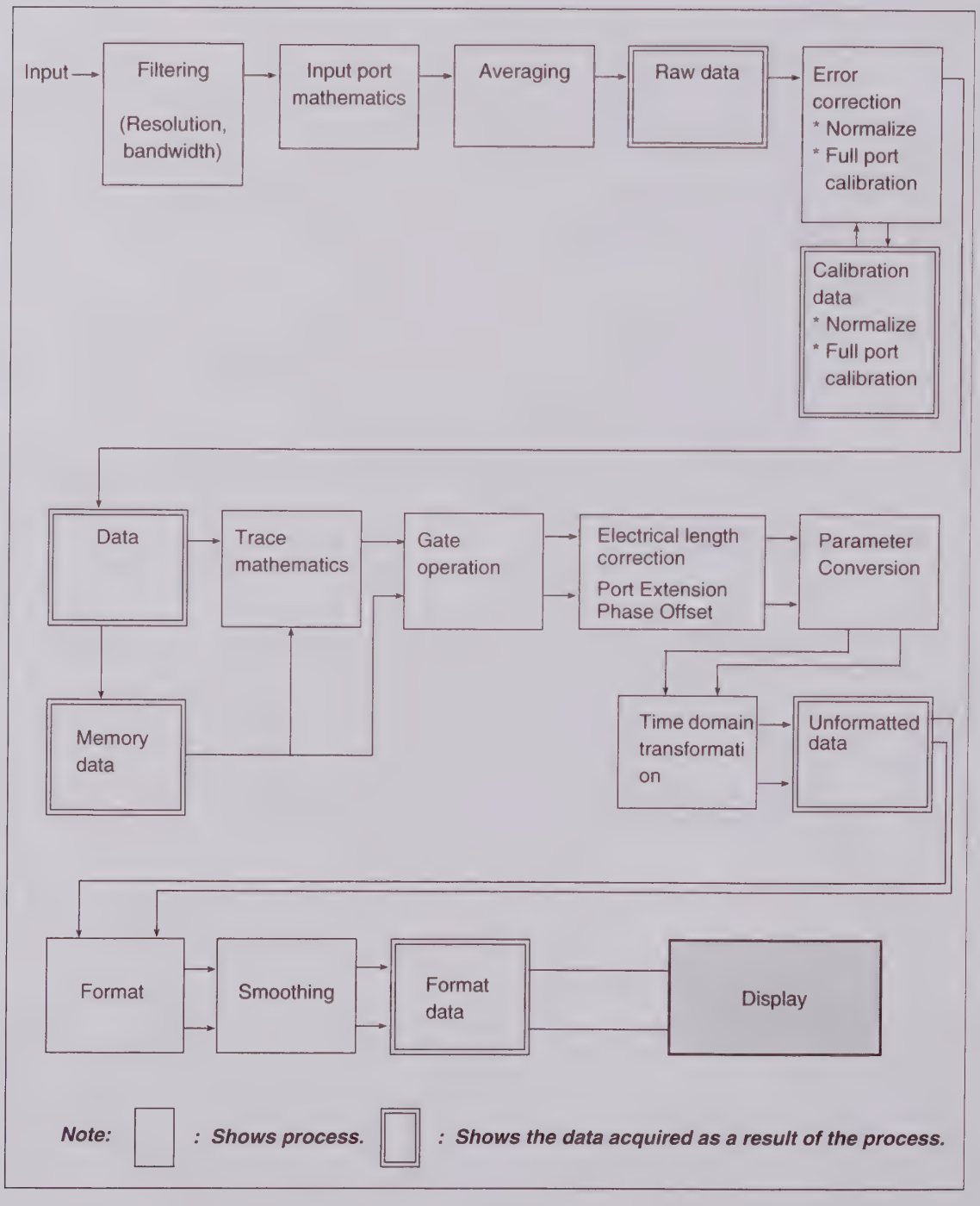


Figure 9-1 Data Flow

10 PERFORMANCE TEST

This chapter describes the test method to keep the performance of the R3765/67G series.

Contact ADVANTEST for other test methods than the items described in this chapter.

10.1 Preparing for a Performance Test

10.1.1 Warm up

Warm up the R3765/67G series for at least 30 minutes (pre-heating).
Also, warm up each calibration standards as well.

10.1.2 Preparing Measurement Instrument

The following measurement instruments are required referring to the test items listed in Table 10-1.

Table 10-1 Required Measurement Instrument for Performance Test (1 of 3)

Test items	Measurement Instrument		Remarks
Frequency accuracy and range	• Counter Frequency : 300kHz to 3.8GHz (R3765G Series) 300kHz to 8.0GHz (R3767G Series) Display : 7 digits or more Accuracy : 0.1ppm or less	R5372 (to 18GHz) or R5373 (to 26GHz) (ADVANTEST-made)	Refer to section 10.2
	• RF cable BNC-BNC, N-N Type		
	• 50Ω to 75Ω conversion adapter (when OPT 12 or 13 is installed)	11852 B (Agilent Technologies)	
Output/input level and flatness	• Power meter Frequency : 300kHz to 8GHz Power range: -21dBm to +17dBm	NRVS (R&S) (Calibrated under the national standard)	Refer to section 10.3
	• Power sensor Frequency : 300kHz to 8GHz Power range: -21dBm to +17dBm	NRV - Z51(R&S) (DC to 18GHz)	
	• Network analyzer	R3765/67CG (ADVANTEST-made)	
	• 50Ω to 75Ω conversion adapter (when OPT 12 or 13 is installed)	11852 B (Agilent Technologies)	
	• 75Ω n-type through (when OPT 12 or 13 is installed)	85036-60014 (Agilent Technologies)	

Table 10-1 Required Measurement Instrument for Performance Test (2 of 3)

Test items	Measurement Instrument		Remarks
Output level linearity	• Power meter Frequency : 300kHz to 3.8GHz (R3765G Series) 300kHz to 8GHz (R3767G Series) Power range: -21dBm to +17dBm	NRVS (R&S) (Calibrated under the national standard)	Refer to section 10.4
	• Power sensor Frequency : 300kHz to 3.8GHz (R3767G Series) 300kHz to 8GHz (R3767G Series) Power range: -21dBm to +17dBm	NRV - Z51 (R&S) (DC to 18GHz)	
	• 50Ω to 75Ω conversion adapter (when OPT 12 or 13 is installed)	11852 B (Agilent Technologies)	
Directivity	• Calibration kit	Model 9617A3 (DC to 18GHz, N type connector) Model 9617M3 (For OPT 12 or 13) (DC to 3.8GHz, N75Ω)	Refer to section 10.5
Test port load match	• Calibration kit • Directivity bridge	Model 9617A3 (DC to 18GHz, N type connector) ZRB2VAR-52 (5MHz to 3GHz) Model 9617M3 (For OPT 12 or 13) (DC to 3.8GHz, N75Ω)	Refer to section 10.6
Crosstalk	• Calibration kit	Model 9617A3 (DC to 18GHz, N type connector) Model 9617M3 (For OPT 12 or 13) (DC to 3.8GHz, N75Ω)	Refer to section 10.8

Table 10-1 Required Measurement Instrument for Performance Test (3 of 3)

Test items	Measurement Instrument		Remarks
Dynamic accuracy	• Step attenuator Variable range: 0 dB to 90 dB Accuracy : Within 0.02 dB	HP8496B (Calibrated under the national standard)	Refer to section 10.9
	• RF cables (SMA(m)/SMA(m) 50Ω) × 2	A01253-060	
	• Conversion connectors (N(m)/SMA(f)) × 2	HRM-554S	
	• 3dB fixed attenuators (SMA(f)/SMA(m)) × 2	AT-103	
	• 50Ω to 75Ω conversion adapter (when OPT 12 or 13 is installed) (75ΩN(m)/50ΩN(f)) × 2	11852B (Agilent Technologies)	
Attenuation accuracy (OPT10)	• RF cable (SMA(m)/SMA(m) 50Ω)	A01253-060	
	• Conversion connectors (N(m)/SMA(f)) × 2	HRN-554S	
	• RF cable (For OPT12 or 13) (N(m)/N(m) 75Ω)	8120-6468 (Agilent Technologies)	

10.1.3 General Note

- Use an AC power source having a voltage of 90V to 250V and a frequency of 48Hz to 66Hz.
- When connecting the power supply cable, turn OFF the POWER switch.
- The R3765/67G series must be tested under the following conditions:

  Temperature : +23°C to ±5°C
  Relative humidity : 80% RH or less
  Free from dust, vibration and noise.

10.2 Frequency Accuracy and Range

Testing procedure

① Setup the R3765/67G series as follows:

For the AG type, connect the other side of the cable to the SOURCE terminal.
For the BG, the CG type or OPT11/13/14, connect the other side of the cable to TEST PORT1.

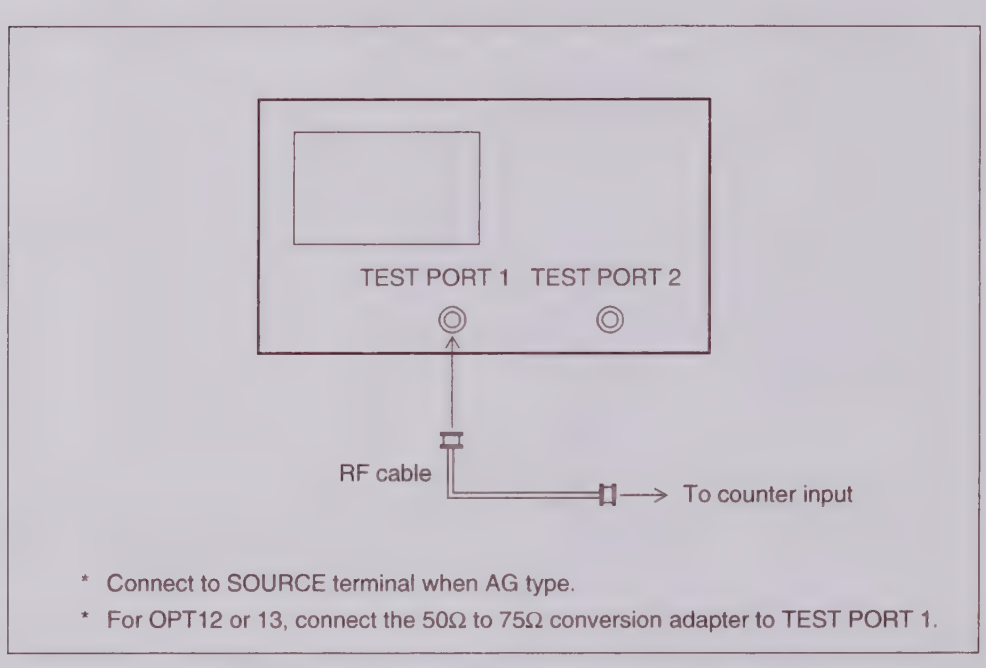

TEST PORT 1
TEST PORT 2
RF cable
To counter input
* Connect to SOURCE terminal when AG type.
* For OPT12 or 13, connect the 50Ω to 75Ω conversion adapter to TEST PORT 1.

Figure 10-1 Frequency Accuracy and Range

② Set the R3765/67G series as follows:

Span : 0Hz
Trigger mode : HOLD

③ Change any center frequency in the range of 300kHz to 3.8GHz (R3767G Series; to 8.0GHz).

④ <Check> : Counter read frequency < center frequency ± center frequency × 10 × 10^{-6}

(Example)
When the center frequency is 100MHz : 100MHz ± 1kHz (in 23°C to ±5°C)
That is, 99999000Hz to 100001000Hz is enable.

10.3 Output Level Accuracy and Flatness

10.3.1 Setup

Setup the R3765/67G series as follows:

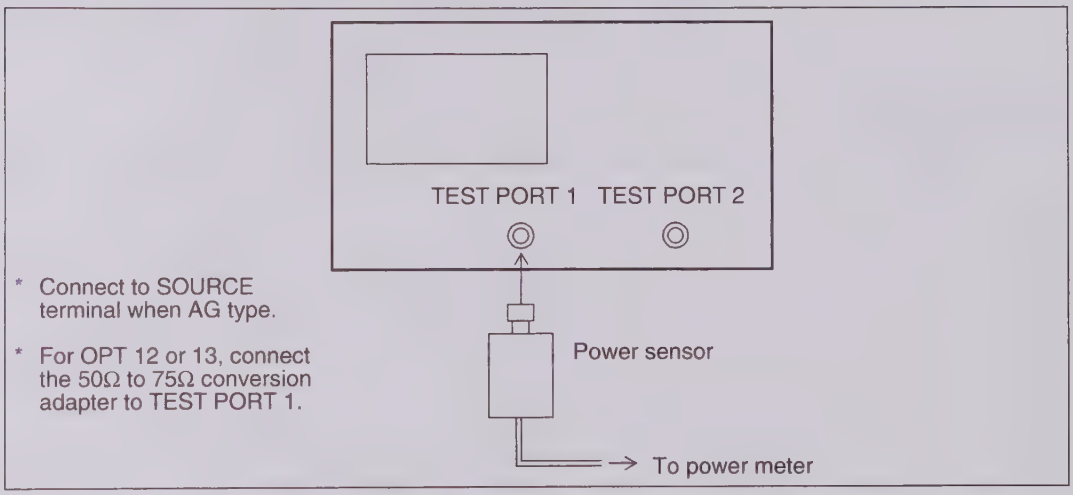

TEST PORT 1
TEST PORT 2
* Connect to SOURCE terminal when AG type.
* For OPT 12 or 13, connect the 50Ω to 75Ω conversion adapter to TEST PORT 1.
Power sensor
To power meter

Figure 10-2 Output Level Accuracy and Flatness

10.3.2 Output Level Accuracy

Testing procedure

① Calibrate the power meter to zero.

② Set the R3765/67G series as follows.

Center frequency : 50MHz
Span : 0Hz
Output level : AG type 7 dBm (2 dBm for OPT 10)
BG type -3 dBm (-8 dBm for OPT 10, -1 dBm for OPT 12, -6 dBm for OPT 10 + OPT 12)
CG type 0 dBm (-5 dBm for OPT 10, OPT 10 + OPT 11 or 14, -6 dBm for OPT 12 or 13, -11 dBm for OPT 10 + OPT 12 or 13)
Sweep mode : HOLD

③ For the AG type, connect the other side of the cable to the SOURCE terminal.
For the AG type, connect the power sensor to the SOURCE terminal.
For the BG or CG type with OPT 11, OPT 13 or OPT 14 installed, connect the power sensor to TEST PORT 1.

Note: The calibration factor is set to 50MHz.

④ <Check> : Output level accuracy (under the output obtained in Step ② above at 50 MHz) (0.5dB within a temperature range of 23°C to ±5°C)
For OPT 11, OPT 13 or OPT 14 , the above output accuracy is guaranteed using TEST PORT 1.
For OPT 12 or OPT 13, add 5.7 dB (of the 50Ω to 75Ω conversion adapter loss) to the output level.
For BG (OPT 12), -6.7 dBm ±0.5 dB
For CG (OPT 12 or 13), -11.7 dBm ±0.5 dB

10.3.3 Flatness

Preparations for measurements using OPT 12 and OPT 13 (acquiring frequency characteristic data of the 50Ω to 75Ω converter adapter)

① Measure the frequency characteristic of the 50Ω to 75Ω conversion adapter as shown in Figure 10-3.
Define the peak to peak value of the frequency characteristics as X dB.

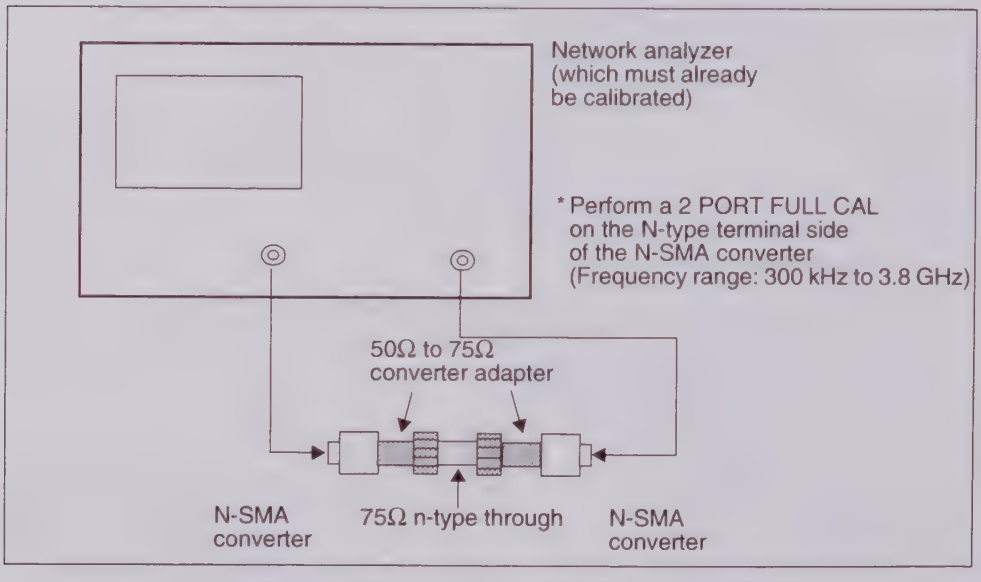


Figure 10-3 50Ω to 75Ω Conversion Adapter

Testing procedure

① Calibrate the power meter to zero.

② Set the R3765/67G series as follows.

Center frequency : 50MHz
Span : 0Hz
Output level : AG type 7 dBm (2 dBm for OPT 10)
BG type -3 dBm (-8 dBm for OPT 10, -1 dBm for OPT 12,
-6 dBm for OPT 10 + OPT 12)
CG type 0 dBm (-5 dBm for OPT 10, OPT 10 + OPT 11 or 14,
-6 dBm for OPT 12 or 13,
-11 dBm for OPT 10 + OPT 12 or 13)
Sweep mode : HOLD

③ The span and output level are fixed. Change the center frequency and obtain data from the power meter.

Note: Use the calibration factor at the center frequency.

④ <Check> : Flatness(under the output obtained in Step ② above at 50 MHz)
2.0dBpp (in 23°C to ±5°C)
For OPT 12 and 13
Flatness = Measurement value + X ≤ 2 dBp-p (at 23°C ±5°C)
For OPT 11, OPT 13 and OPT 14, the flatness is specified in reference to TEST PORT1.

10.4 Output Level Linearity

Testing procedure

① Calibrate the power meter to zero.

② Set the R3765/67G series as follows.

Center frequency : 50MHz
Span : 0Hz
Output level : AG type 7 dBm (2 dBm for OPT 10)
BG type -3 dBm (-8 dBm for OPT 10, -1 dBm for OPT 12,
-6 dBm for OPT 10 + OPT 12)
CG type 0 dBm (-5 dBm for OPT 10, OPT 10 + OPT 11 or 14,
-6 dBm for OPT 12 or 13,
-11 dBm for OPT 10 + OPT 12 or 13)
Sweep mode : HOLD

③ Connect the power sensor to the output terminal and perform the measurement. (Refer to Figure 10-4.)
For the AG type, connect the power sensor to the SOURCE terminal.
For the BG or CG type with OPT 11, OPT 13 or OPT 14 installed, connect the power sensor to TEST PORT 1.

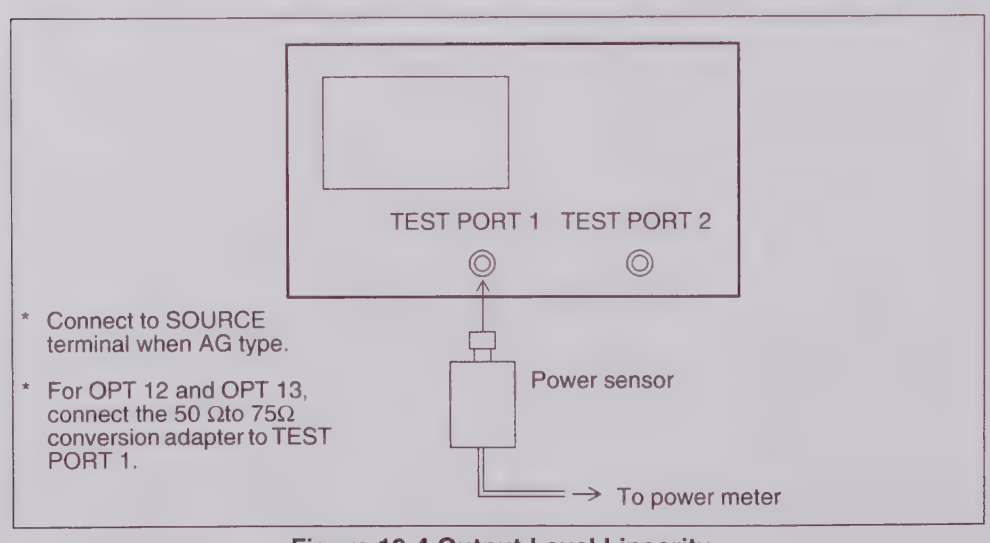

TEST PORT 1
TEST PORT 2
* Connect to SOURCE terminal when AG type.
* For OPT 12 and OPT 13, connect the 50 Ωto 75Ω conversion adapter to TEST PORT 1.
Power sensor
To power meter

Figure 10-4 Output Level Linearity

④ When changing the output level, obtain linearity data.

Note: The calibration factor is set to 50MHz.

⑤ <Check> : (in 23°C to ±5°C)

- For R3765AG/67AG (Reference +7dBm)
  300kHz to 15MHz
  ±0.4dB (+12dBm to +2dBm)
  ±0.8dB (+17dBm to -3dBm)
  15MHz to 8GHz
  ±0.2dB (+12dBm to +2dBm)
  ±0.4dB (+17dBm to -3dBm)

  For OPT10 (Reference +2dBm)
  300kHz to 15MHz
  ±0.6dB (+7dBm to -3dBm)
  ±1.3dB (+12dBm to -8dBm)
  15MHz to 8GHz
  ±0.4dB (+7dBm to -3dBm)
  ±0.6dB (+12dBm to -8dBm)

- For R3765BG/67BG (Reference -3dBm)
  300kHz to 15MHz
  ±0.4dB (+2dBm to -8dBm)
  ±0.8dB (+7dBm to -13dBm)
  15MHz to 8GHz
  ±0.2dB (+2dBm to -8dBm)
  ±0.4dB (+7dBm to -13dBm)

  For OPT10 (Reference -8dBm)
  300kHz to 15MHz
  ±0.6dB (-3dBm to -13dBm)
  ±1.3dB (+2dBm to -18dBm)
  15MHz to 8GHz
  ±0.4dB (-3dBm to -13dBm)
  ±0.6dB (+2dBm to -18dBm)

  For OPT12 (Reference -1dBm)
  300kHz to 15MHz
  ±0.4dB (+4dBm to -6dBm)
  ±0.8dB (+9dBm to -11dBm)
  15MHz to 3.8GHz
  ±0.2dB (+4dBm to -6dBm)
  ±0.4dB (+9dBm to -11dBm)

  For OPT10 + OPT12 (Reference -6dBm)
  300kHz to 15MHz
  ±0.6dB (-1dBm to -11dBm)
  ±1.3dB (+4dBm to -16dBm)
  15MHz to 3.8GHz
  ±0.4dB (-1dBm to -11dBm)
  ±0.6dB (+4dBm to -16dBm)

- For R3765CG/67CG (Reference 0dBm)
  300kHz to 15MHz
  ±0.4dB (+5dBm to -5dBm)
  ±0.8dB (+10dBm to -10dBm)
  15MHz to 8GHz
  ±0.2dB (+5dBm to -5dBm)
  ±0.4dB (+10dBm to -10dBm)

  For OPT 10 or OPT 10 + OPT 11 (Reference -5dBm)
  300kHz to 15MHz
  ±0.6dB (0dBm to -10dBm)
  ±1.3dB (+5dBm to -15dBm)
  15MHz to 8GHz
  ±0.4dB (0dBm to -10dBm)
  ±0.6dB (+5dBm to -10dBm)

  For OPT 10 + OPT 12 or OPT 13 (Reference -11dBm)
  300kHz to 15MHz
  ±0.6dB (-6dBm to -16dBm)
  ±1.3dB (-1dBm to -21dBm)
  15MHz to 3.8GHz
  ±0.4dB (-6dBm to -16dBm)
  ±0.6dB (-1dBm to -21dBm)

  For OPT 10 + OPT 14 (Reference -5dBm)
  300kHz to 15MHz
  ±0.6dB (0dBm to -10dBm)
  ±1.3dB (+3dBm to -15dBm)
  15MHz to 8GHz
  ±0.4dB (0dBm to -10dBm)
  ±0.6dB (+3dBm to -15dBm)

  For OPT 12 or OPT 13 (Reference -6dBm)
  300kHz to 15MHz
  ±0.4dB (-1dBm to -11dBm)
  ±0.8dB (+4dBm to -16dBm)
  15MHz to 3.8GHz
  ±0.2dB (-1dBm to -11dBm)
  ±0.4dB (+4dBm to -16dBm)

  For OPT14 (Reference -2dBm)
  300kHz to 15MHz
  ±0.4dB (+5dBm to -5dBm)
  ±0.8dB (+8dBm to -10dBm)
  15MHz to 8GHz
  ±0.2dB (+5dBm to -5dBm)
  ±0.4dB (+8dBm to -10dBm)

10.5 Directivity

Testing procedure

① Setup the R3765/67G series as follows.

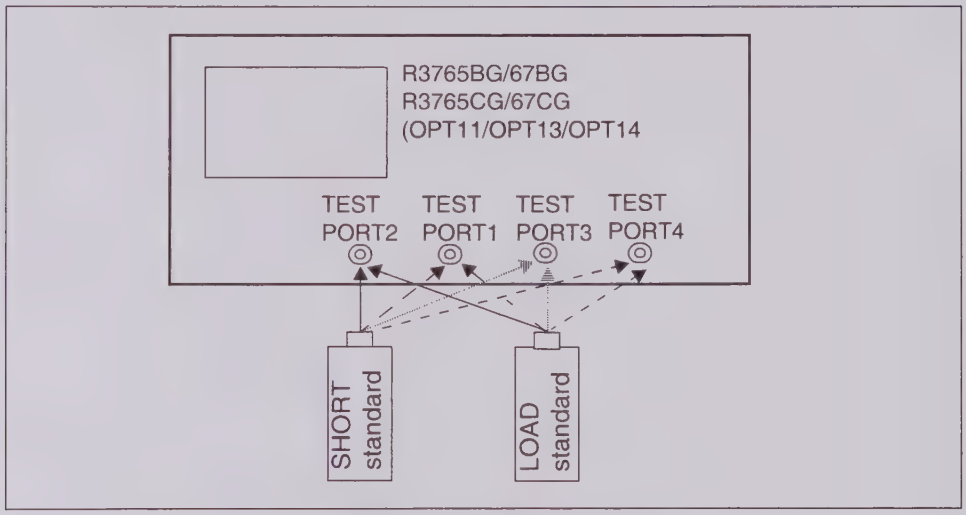


Figure 10-5 Directivity

② Perform the normalize (SHORT) of TEST PORT 1.
(For OPT11, **[MEAS]** → *{S11 (PORT 1)}*)

(a) **[MEAS]** → *{S11 REFL FWD}* or **[MEAS]** → *{REFLECTION}*.
(b) Connect the short standard to TEST PORT 1.
(c) **[CAL]** → *{NORMALIZE (SHORT)}*.

③ Connect the load standard to TEST PORT 1 and read the value of directivity from trace data with the marker.

④ <Check> : The directivity of TEST PORT 1 (in 23°C ± 5°C)

300kHz to 40MHz : -28dB or less
40MHz to 2.6GHz : -30dB or less
2.6GHz to 3.8GHz : -26dB or less
3.8GHz to 8.0GHz : -22dB or less (R3767BG/67CG only)
OPT 12 or OPT 13
300kHz to 40MHz : -28dB or less
40MHz to 2.0GHz : -27dB or less
2.0GHz to 3.8GHz : -22dB or less

- The following Steps ⑤ thru ⑦ are only for R3765CG/67CG with OPT 11, OPT 13 or OPT 14 installed.

⑤ Perform the normalize (SHORT) of TEST PORT 2.

(a) **[MEAS]** → *{S22 REFL REV}*.
(For OPT 11, OPT 13 or OPT 14, **[MEAS]** → *{S22 (PORT 2)}*)
(b) Connect the short standard to TEST PORT 2.
(c) **[CAL]** → *{NORMALIZE (SHORT)}*.
(d) Remove the short standard.

⑥ Connect the load standard to TEST PORT 2 and read the value of directivity from trace data with the marker.

⑦ <Check> : The directivity of TEST PORT 2 (in 23°C ± 5°C)

300kHz to 40MHz : -28dB or less
40MHz to 2.6GHz : -30dB or less
2.6GHz to 3.8GHz : -26dB or less
3.8GHz to 8.0GHz : -22dB or less (R3767CG only))
OPT 12 or OPT 13
300kHz to 40MHz : -28dB or less
40MHz to 2.0GHz : -27dB or less
2.0GHz to 3.8GHz : -22dB or less

- The following Steps ⑧ thru ⑩ are only used for OPT 11, OPT 13 or OPT 14.

⑧ Perform the normalize (SHORT) of TEST PORT 3.

(a) **[MEAS]** → *{TEST - PORT CONNECTION}* → *{S33 (PORT3)}*.
(b) Connect the short standard to TEST PORT 3.
(c) **[CAL]** → *{NORMALIZE (SHORT)}*.
(d) Remove the short standard.

⑨ Connect the load standard to TEST PORT 3 and read the value of directivity from trace data with the marker.

⑩ <Check> : The directivity of TEST PORT 3 (in 23°C ± 5°C)

300kHz to 40MHz : -28dB or less
40MHz to 2.6GHz : -30dB or less
2.6GHz to 3.8GHz : -26dB or less
3.8GHz to 8.0GHz : -22dB or less (R3767CG only)
OPT 12 or OPT 13
300kHz to 40MHz : -28dB or less
40MHz to 2.0GHz : -27dB or less
2.0GHz to 3.8GHz : -22dB or less

- The following procedure applies to OPT14.

⑪ Perform the normalize (SHORT) of TEST PORT 4.

(a) **[MEAS]** → *{TEST - PORT CONNECTION}* → *{S44 (PORT4)}*.
(b) Connect the short standard to TEST PORT 4.
(c) **[CAL]** → *{NORMALIZE (SHORT)}*.
(d) Remove the short standard.

⑫ Connect the load standard to TEST PORT 4 and read the value of directivity from trace data with the marker.

⑬ <Check> : The directivity of TEST PORT 4 (in 23°C ± 5°C)

300kHz to 40MHz : -28dB or less
40MHz to 2.6GHz : -30dB or less
2.6GHz to 3.8GHz : -26dB or less
3.8GHz to 8.0GHz : -22dB or less (R3767CG only)

10.6 Load Match of Test Port

10.6.1 When R3765AG/67AG

(1) Load match measurement of A PORT

Testing procedure

① Setup the R3765AG/67AG as follows.

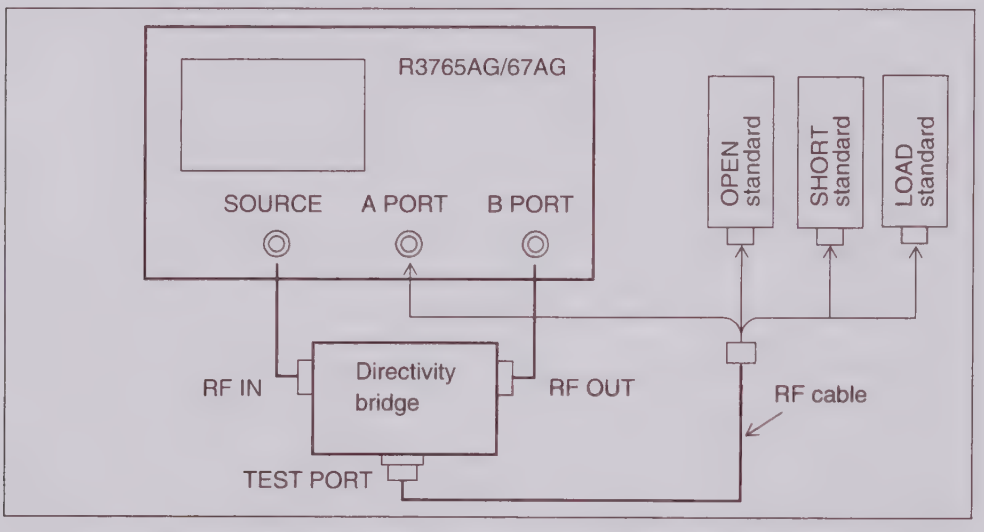


Figure 10-6 Load Match Measurement of A PORT (R3765AG/67AG)

② Perform 1 port full calibration

(a) **[MEAS]** → *{B/R}*.
(b) **[CAL]** → *{CAL MENUS}* → *{1 PORT FULL CAL}*.
(c) Connect the open standard to the tip of RF cable and press *{OPEN}*.
(d) Connect the short standard to the tip of RF cable and press *{SHORT}*.
(e) Connect the load standard to the tip of RF cable and press *{LOAD}*.
(f) Press *{DONE 1 PORT}*.

③ Connect A PORT of the R3765AG/67AG and the tip of RF cable.

④ Read the load match of A PORT from trace data with the marker.

⑤ <Check> : A PORT load match (in 23°C ± 5°C)

300kHz to 40MHz : -16dB or less
40MHz to 2.6GHz : -18dB or less
2.6GHz to 3.8GHz : -16dB or less
3.8GHz to 8.0GHz : -14dB or less (R3767AG only)

(2) Load match measurement of B PORT

Testing procedure

① Setup the R3765AG/67AG as follows.

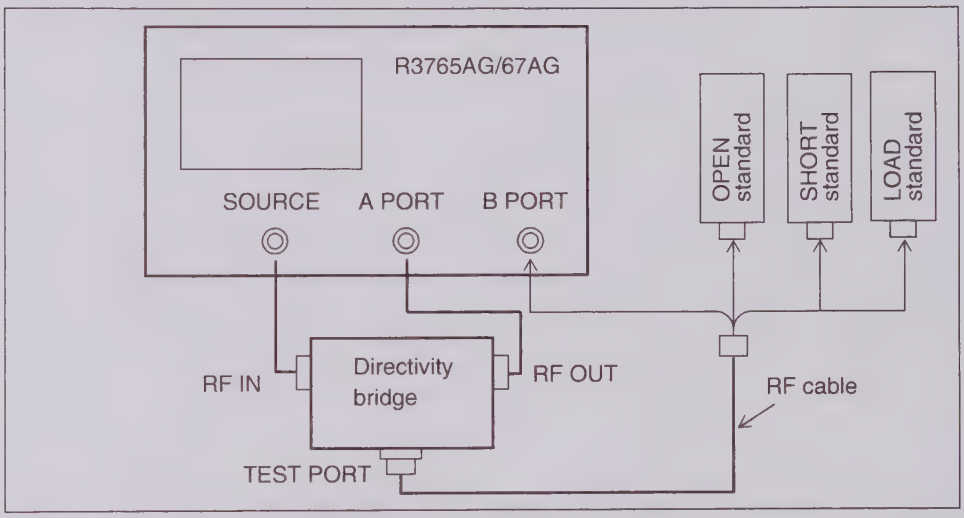


Figure 10-7 Load Match Measurement of B PORT (R3765AG/67AG)

② Perform 1 port full calibration.

(a) **[MEAS]** → *{A/R}*.
(b) **[CAL]** → *{CAL MENUS}* → *{1 PORT FULL CAL}*.
(c) Connect the open standard to the tip of RF cable and press *{OPEN}*.
(d) Connect the short standard to the tip of RF cable and press *{SHORT}*.
(e) Connect the load standard to the tip of RF cable and press *{LOAD}*.
(f) Press *{DONE 1 PORT}*.

③ Connect A PORT of the R3765AG/67AG and the tip of RF cable.

④ Read the load match of B PORT from trace data with the marker.

⑤ <Check> : B PORT load match (in 23°C ± 5°C)

300kHz to 40MHz : -16dB or less
40MHz to 2.6GHz : -18dB or less
2.6GHz to 3.8GHz : -16dB or less
3.8GHz to 8.0GHz : -14dB or less (R3767AG only)

10.6.2 When R3765BG/67BG

Testing procedure

① Setup the R3765BG/67BG as follows.

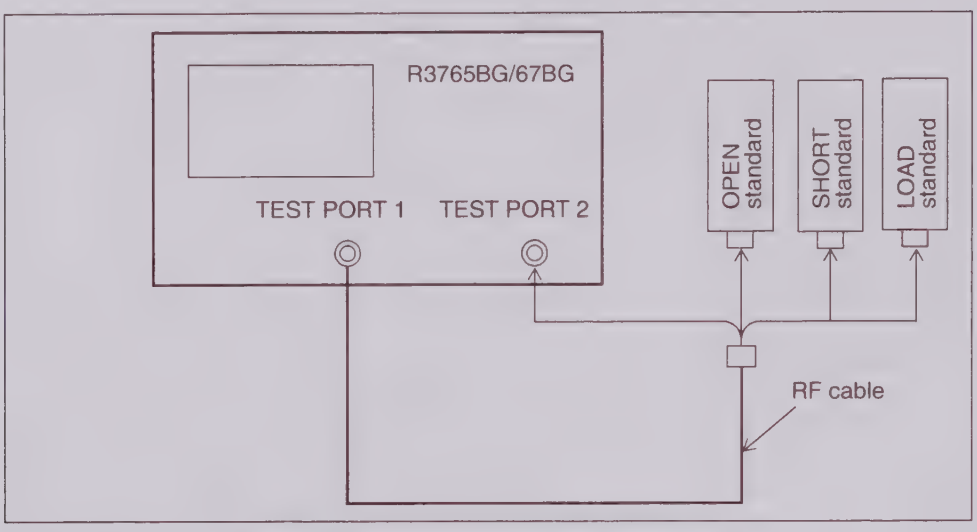


Figure 10-8 Setup (R3765BG/67BG)

② Perform 1 port full calibration

(a) **[MEAS]** → *{REFLECTION}*.
(b) **[CAL]** → *{CAL MENUS}* → *{1 PORT FULL CAL}*.
(c) Connect the open standard to the tip of RF cable and press *{OPEN}*.
(d) Connect the short standard to the tip of RF cable and press *{SHORT}*.
(e) Connect the load standard to the tip of RF cable and press *{LOAD}*.
(f) Press *{DONE 1 PORT}*.

③ Connect TEST PORT 2 of the R3765BG/67BG and the tip of RF cable.

④ Read the load match of TEST PORT 2 from trace data with the marker.

⑤ <Check> : TEST PORT 2 load match (in 23°C ± 5°C)

300kHz to 40MHz : -16dB or less
40MHz to 2.6GHz : -18dB or less
2.6GHz to 3.8GHz : -16dB or less
3.8GHz to 8.0GHz : -14dB or less (R3767BG only)
OPT 12
300kHz to 2.0GHz : -16dB or less
2.0GHz to 3.8GHz : -15dB or less

10.6.3 When R3765CG/67CG

(1) Load match measurement of TEST PORT 1

Testing procedure

① Setup the R3765CG/67CG as follows.

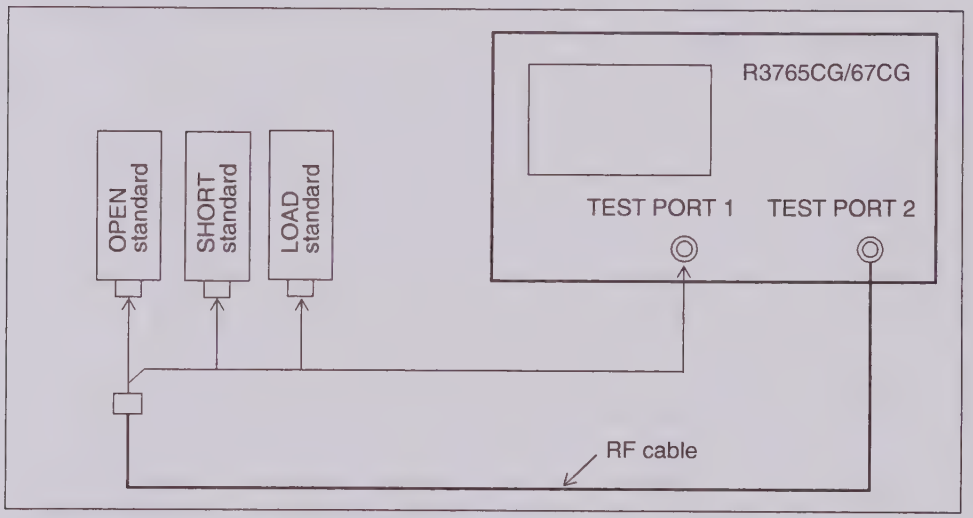


Figure 10-9 Load Match Measurement of TEST PORT 1 (R3765CG/67CG)

② Perform 1 port full calibration

(a) **[MEAS]** → *{S22 REFL REV}*. (For OPT11/OPT14, *{S22 (PORT 2)}*)
(b) **[CAL]** → *{CAL MENUS}* → *{1 PORT FULL CAL}*.
(c) Connect the open standard to the tip of RF cable and press *{OPEN}*.
(d) Connect the short standard to the tip of RF cable and press *{SHORT}*.
(e) Connect the load standard to the tip of RF cable and press *{LOAD}*.
(f) Press *{DONE 1 PORT}*.

③ Connect TEST PORT 1 of the R3765CG/67CG and the tip of RF cable.

④ Read the load match of TEST PORT 1 from trace data with the marker.

⑤ <Check> : TEST PORT 1 load match (in 23°C ± 5°C)

300kHz to 40MHz : -16dB or less
40MHz to 2.6GHz : -18dB or less
2.6GHz to 3.8GHz : -16dB or less
3.8GHz to 8.0GHz : -14dB or less (R3767CG only)
OPT 12
300kHz to 2.0GHz : -16dB or less
2.0GHz to 3.8GHz : -15dB or less

(2) Load match measurement of TEST PORT 2

Testing procedure

① Setup the R3765CG/67CG as follows.

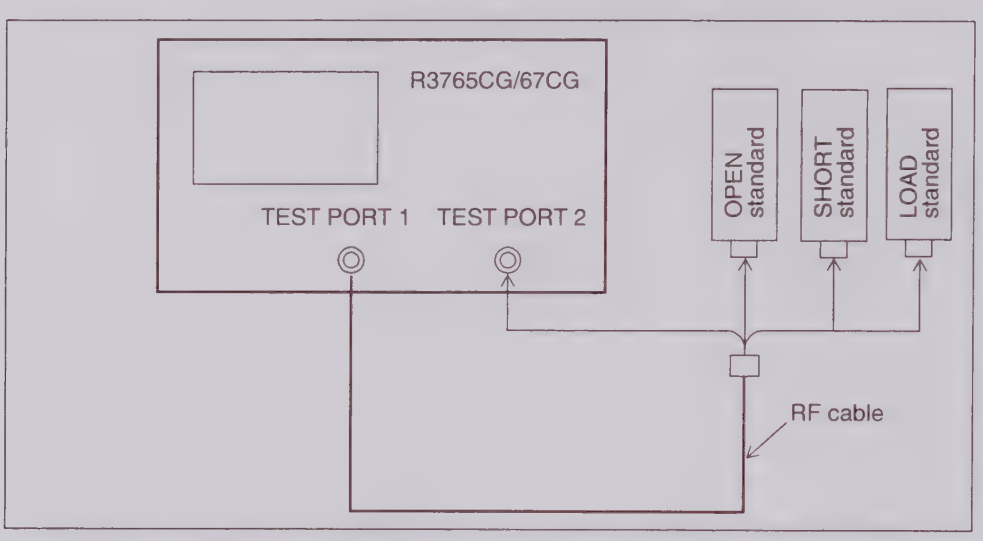


Figure 10-10 Load Match Measurement of TEST PORT 2 (R3765CG/67CG)

② Perform 1 port full calibration

(a) **[MEAS]** → *{S11 REFL FWD}*. (For OPT11/OPT14, *{S11 (PORT 1)}*)
(b) **[CAL]** → *{CAL MENUS}* → *{1 PORT FULL CAL}*.
(c) Connect the open standard to the tip of RF cable and press *{OPEN}*.
(d) Connect the short standard to the tip of RF cable and press *{SHORT}*.
(e) Connect the load standard to the tip of RF cable and press *{LOAD}*.
(f) Press *{DONE 1 PORT}*.

③ Connect TEST PORT 2 of the R3765CG/67CG and the tip of RF cable.

④ Read the load match of TEST PORT 2 from trace data with the marker.

⑤ <Check> : TEST PORT 2 load match (in 23°C ± 5°C)

300kHz to 40MHz : -16dB or less
40MHz to 2.6GHz : -18dB or less
2.6GHz to 3.8GHz : -16dB or less
3.8GHz to 8.0GHz : -14dB or less (R3767CG only)
OPT 12
300kHz to 2.0GHz : -16dB or less
2.0GHz to 3.8GHz : -15dB or less

- The following procedure is only used for OPT 11, OPT 13 or OPT 14.

(3) Load match measurement of TEST PORT 3/TEST PORT 4

Testing procedure

① Setup the R3765CG/67CG as follows.

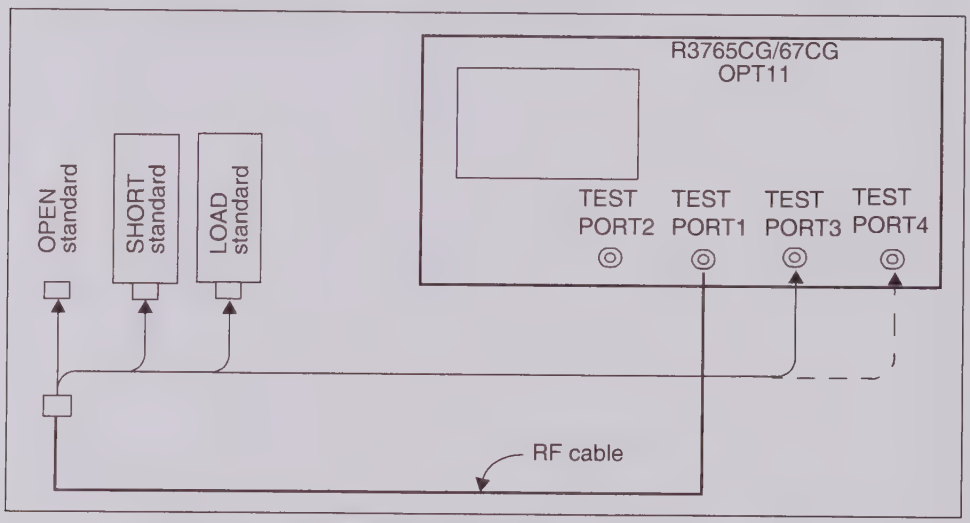


Figure 10-11 Load Match Measurement of TEST PORT 3 (OPT11/OPT14)

② Perform 1 port full calibration

(a) **[MEAS]** → *{S11 (PORT 1)}*.
(b) **[CAL]** → *{CAL MENUS}* → *{1 PORT FULL CAL}*.
(c) Connect the open standard to the tip of RF cable and press *{OPEN}*.
(d) Connect the short standard to the tip of RF cable and press *{SHORT}*.
(e) Connect the load standard to the tip of RF cable and press *{LOAD}*.
(f) Press *{DONE 1 PORT}*.

③ Connect TEST PORT 3 of the R3765CG/67CG and the tip of RF cable.

④ Read the load match of TEST PORT 3 from trace data with the marker.

⑤ <Check> : TEST PORT 3 load match (in 23°C ± 5°C)

300kHz to 40MHz : -16dB or less
40MHz to 2.6GHz : -18dB or less
2.6GHz to 3.8GHz : -16dB or less
3.8GHz to 8.0GHz : -14dB or less
(For R3767CG with OPT 11 or OPT 14 installed)

OPT 13
300kHz to 2.0GHz : -16dB or less
2.0GHz to 3.8GHz : -15dB or less

- The procedure shown below only applies to OPT14.

⑥ Change the RF cable end from TEST PORT3 to TEST PORT4

⑦ Read the load match of TEST PORT 4 from trace data with the marker.

⑧ <Check> : TEST PORT 4 load match (in 23°C ± 5°C)

300kHz to 40MHz : -16dB or less
40MHz to 2.6GHz : -18dB or less
2.6GHz to 3.8GHz : -16dB or less
3.8GHz to 8.0GHz : -14dB or less (R3767CG OPT14 only)

10.7 Noise Level

Testing procedure

① Set the R3765/67G series as follows.

(a) **[SCALE]** → *{/DIV}* → **[1]** → **[0]** → **[x1]**.

- For R3765AG/67AG, see step ②.
- For R3765BG/67BG, see step ③.
- For R3765CG/67CG, see step ④.
- For OPT11/OPT14, see step ⑤

(b) **[AVG]** → **[3]** → **[kHz]**.

CAUTION!

1. ***The phase lock of the signal source is set to OFF by this operation, so that the receiver section is not affected by the leakage from the signal source, by which only the noise level in the receiver section can be measured.***

2. ***The input port must not be connected with anything.***

② When R3765AG/67AG

- Measure the noise level of A input and B input according to the following procedure.

(a) Press **[MEAS]** & *{A}* to display the noise level of A input.
(b) **[AVG]** → *{SMOOTHING ON}* → *{SMOOTHING APERTURE}* → **[2]** → **[0]** → **[x1]**.
(c) **[SYSTEM]** → *{SERVICE MENU}* → *{SERVICE MODES}* → *{SOURCE PLL OFF}*.
(d) Read the noise level value by the marker.
(e) Press **[MEAS]** & *{B}* to display the noise level of B input.
(f) **[AVG]** → *{SMOOTHING ON}* → *{SMOOTHING APERTURE}* → **[2]** → **[0]** → **[x1]**.
(g) **[SYSTEM]** → *{SERVICE MENU}* → *{SERVICE MODES}* → *{SOURCE PLL OFF}*.
(h) Read the noise level value by the marker.

<Check> : Noise level (3kHz bandwidth)
300kHz to 40MHz : -85dB or less
40MHz to 3.8GHz : -90dB or less
3.8GHz to 8.0GHz : -80dB or less (R3767AG only)

③ When R3765BG/67BG

(a) Press **[SYSTEM]** → *{SERVICE MENU}* → *{SERVICE MODE}* → *{MAINTENANCE MEAS MENU}* → *{B}* to display the noise level of B input.
(b) **[AVG]** → *{SMOOTHING ON}* → *{SMOOTHING APERTURE}* → **[2]** → **[0]** → **[x1]**.
(c) **[SYSTEM]** → **[SYSTEM]** → *{SERVICE MENU}* → *{SERVICE MODE}* → *{SOURCE PLL OFF}*.
(d) Read the noise level value by the marker.

<Check> : Noise level (3kHz bandwidth)
300kHz to 40MHz : -79dB or less
40MHz to 3.8GHz : -84dB or less
3.8GHz to 8GHz : -74dB or less (R3767BG only)

④ When R3765CG/67CG

- Measure the noise level of A input.

(a) **[MEAS]** → *{S12 TRANS REV}*.
(b) Press **[SYSTEM]** → *{SERVICE MENU}* → *{SERVICE MODE}* → *{MAINTENANCE MEAS MENU}* → *{A}* to display the noise level of A input.
(c) **[AVG]** → *{SMOOTHING ON}* → *{SMOOTHING APERTURE}* → **[2]** → **[0]** → **[x1]**.
(d) **[SYSTEM]** → **[SYSTEM]** → *{SERVICE MENU}* → *{SERVICE MODES}* → *{SOURCE PLL OFF}*.
(e) Read the noise level value by the marker.

- Measure the noise level of B input.

(a) **[MEAS]** → *{S21 TRANS FWD}*.
(b) Press **[SYSTEM]** → *{SERVICE MENU}* → *{SERVICE MODE}* → *{MAINTENANCE MEAS MENU}* → *{B}* to display the noise level of B input.
(c) **[AVG]** → *{SMOOTHING ON}* → *{SMOOTHING APERTURE}* → **[2]** → **[0]** → **[x1]**.
(d) **[SYSTEM]** → **[SYSTEM]** → *{SERVICE MENU}* → *{SERVICE MODES}* → *{SOURCE PLL OFF}*.
(e) Read the noise level value by the marker.

<Check> : Noise level (3kHz bandwidth)
300kHz to 40MHz : -73dB or less
40MHz to 3.8GHz : -78dB or less
3.8GHz to 8GHz : -68dB or less (R3767CG only)

For OPT 12
300kHz to 40MHz : -65dB or less
40MHz to 3.8GHz : -70dB or less

⑤ For OPT 11, OPT 13 or OPT 14

- Measure the noise level at Input A.

(a) **[MEAS]** → *{S12 (P2 → P1)}*
(b) **[SYSTEM]** → *{SERVICE MENU}* → *{SERVICE MODE}* → *{MAINTENANCE MEAS MENU}* → *{A}*
(c) **[AVG]** → *{SMOOTHING ON}* → *{SMOOTHING APERTURE}* → **[2]** → **[0]** → **[x1]**.
(d) **[SYSTEM]** → **[SYSTEM]** → *{SERVICE MENU}* → *{SERVICE MODES}* → *{SOURCE PLL OFF}*.
(e) Read the noise level indicated by the marker.

- Measure the noise level at Input B.

(a) **[MEAS]** → *{S12 (P2 ← P1)}*
(b) **[SYSTEM]** → *{SERVICE MENU}* → *{SERVICE MODE}* → *{MAINTENANCE MEAS MENU}* → *{B}*
(c) **[AVG]** → *{SMOOTHING ON}* → *{SMOOTHING APERTURE}* → **[2]** → **[0]** → **[x1]**.
(d) **[SYSTEM]** → **[SYSTEM]** → *{SERVICE MENU}* → *{SERVICE MODES}* → *{SOURCE PLL OFF}*.
(e) Read the noise level indicated by the marker.

- Measure the noise level at Input C.

(a) **[MEAS]** → *{TEST-PORT CONECTION}* → *{S31 (P1 → P3)}*
(b) **[SYSTEM]** → *{SERVICE MENU}* → *{SERVICE MODE}* → *{MAINTENANCE MEAS MENU}* → *{C}*
(c) **[AVG]** → *{SMOOTHING ON}* → *{SMOOTHING APERTURE}* → **[2]** → **[0]** → **[x1]**.
(d) **[SYSTEM]** → **[SYSTEM]** → *{SERVICE MENU}* → *{SERVICE MODES}* → *{SOURCE PLL OFF}*.
(e) Read the noise level indicated by the marker.

<Check> : Noise level (3kHz bandwidth)

OPT 11
300kHz to 40MHz : -73dB or less
40MHz to 3.8GHz : -78dB or less
3.8GHz to 8.0GHz : -68dB or less (R3767CG only)

OPT 13
300kHz to 40MHz : -65dB or less
40MHz to 3.8GHz : -70dB or less

OPT14
300kHz to 40MHz : -73dB or less
40MHz to 3.8GHz : -73dB or less
3.8GHz to 8.0GHz : -63dB or less (R3767CG only)

10.8 Crosstalk

10.8.1 When R3765AG/67AG

(1) Crosstalk measurement of A PORT

Testing procedure

① Setup the R3765AG/67AG as follows.

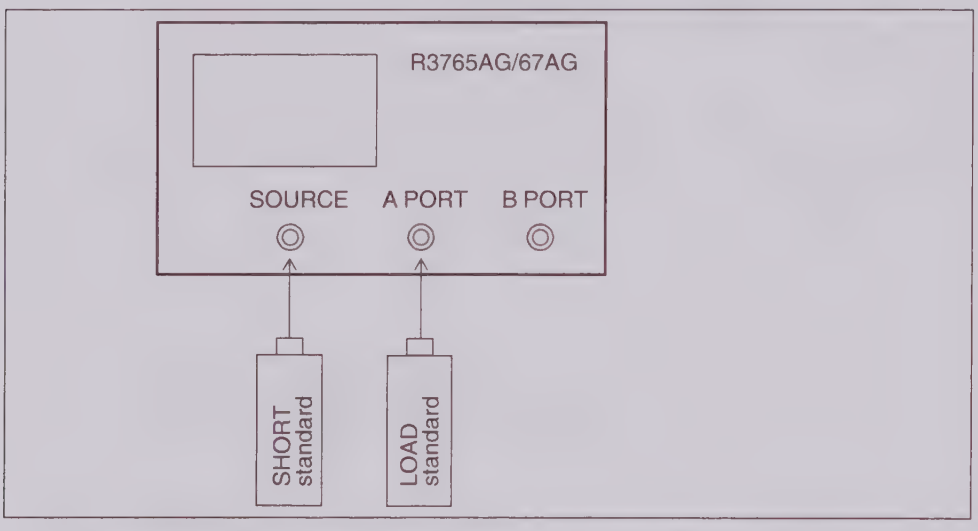


Figure 10-12 Crosstalk Measurement of A PORT (R3765AG/67AG)

② Setup the R3765AG/67AG.

MEAS : A/R
RBW : 100Hz
Average : 16 times

③ Connect the short standard to the SOURCE terminal.

④ Connect the load standard to A PORT.

⑤ Read the crosstalk value of A PORT from the trace data.

⑥ <Check> : Crosstalk of A PORT

300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -100dB or less
2.6GHz to 3.8GHz : -90dB or less
3.8GHz to 5.0GHz : -80dB or less (R3767AG only)
5.0GHz to 8.0GHz : -70dB or less (R3767AG only)

(2) Crosstalk measurement of B PORT

Testing procedure

① Setup the R3765AG/67AG as follows.

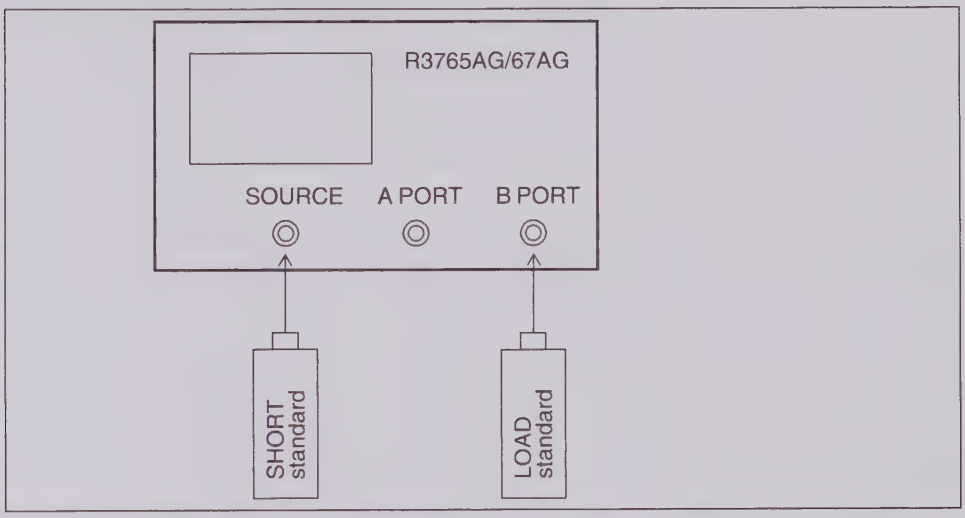


Figure 10-13 Crosstalk Measurement of B PORT (R3765AG/67AG)

② Setup the R3765AG/67AG.

MEAS : B/R
RBW : 100Hz
Average : 16 times

③ Connect the short standard to the SOURCE terminal.

④ Connect the load standard to B PORT.

⑤ Read the crosstalk value of B PORT from the trace data.

⑥ <Check> : Crosstalk of B PORT

300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -100dB or less
2.6GHz to 3.8GHz : -90dB or less
3.8GHz to 5.0GHz : -80dB or less (R3767AG only)
5.0GHz to 8.0GHz : -70dB or less (R3767AG only)

10.8.2 When R3765BG/67BG

Testing procedure

① Setup the R3765BG/67BG as follows.

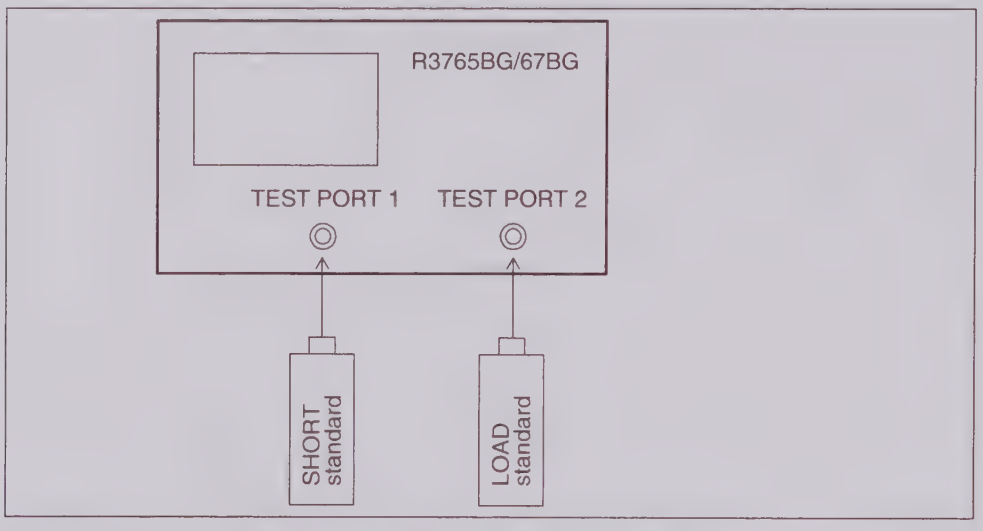


Figure 10-14 Setup (R3765BG/67BG)

② Setup the R3765BG/67BG.

MEAS : TRANSMISSION
RBW : 100Hz
Average : 16 times

③ Connect the short standard to TEST PORT 1.

④ Connect the load standard to TEST PORT 2.

⑤ Read the crosstalk value from the trace data.

⑥ <Check> : Crosstalk (only about TEST PORT 2)

300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -100dB or less
2.6GHz to 3.8GHz : -90dB or less
3.8GHz to 5.0GHz : -80dB or less (R3767BG only)
5.0GHz to 8.0GHz : -70dB or less (R3767BG only)
OPT 12
300kHz to 40MHz : -85dB or less
40MHz to 3.8GHz : -90dB or less

10.8.3 When R3765CG/67CG

(1) Crosstalk of TEST PORT 1

Testing procedure

① Setup the R3765CG/67CG as follows.

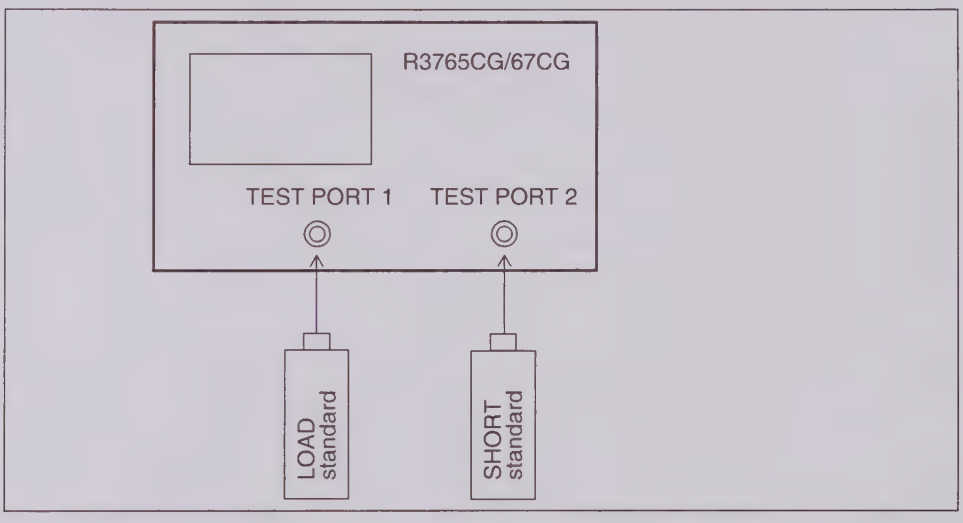


Figure 10-15 Crosstalk of TEST PORT 1 (R3765CG/67CG)

② Setup the R3765CG/67CG.

MEAS : S12 TRANS REV
RBW : 100Hz
Average : 16 times

③ Connect the short standard to TEST PORT 2.

④ Connect the load standard to TEST PORT 1.

⑤ Read the crosstalk value of TEST PORT 1 from the trace data.

⑥ <Check> : Crosstalk of TEST PORT 1

300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -100dB or less
2.6GHz to 3.8GHz : -90dB or less
3.8GHz to 5.0GHz : -80dB or less (R3767CG only)
5.0GHz to 8.0GHz : -70dB or less (R3767CG only)
OPT 12
300kHz to 40MHz : -85dB or less
40MHz to 3.8GHz : -90dB or less

(2) Crosstalk of TEST PORT 2

Testing procedure

① Setup the R3765CG/67CG as follows.

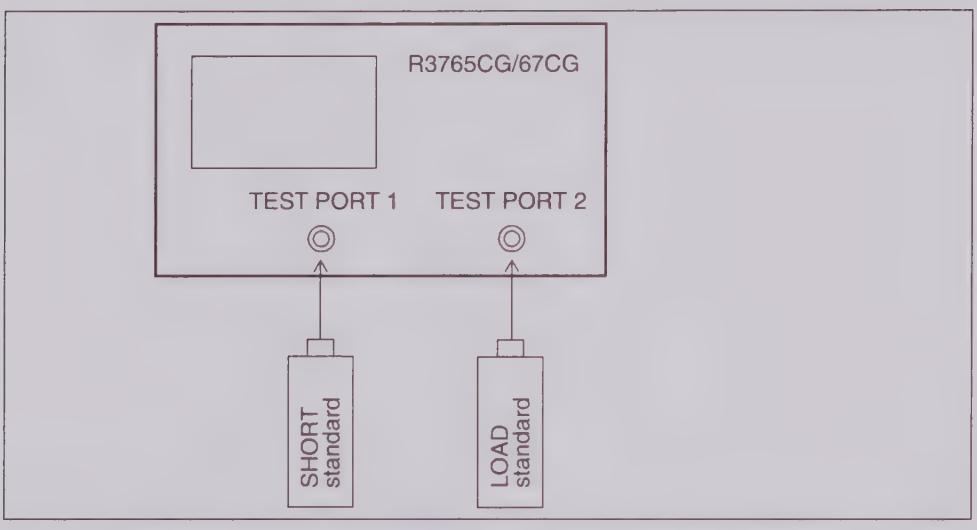


Figure 10-16 Crosstalk of TEST PORT 2 (R3765CG/67CG)

② Setup the R3765CG/67CG.

MEAS : S21 TRANS FWD
RBW : 100Hz
Average : 16 times

③ Connect the short standard to TEST PORT 1.

④ Connect the load standard to TEST PORT 2.

⑤ Read the crosstalk value of TEST PORT 2 from the trace data.

⑥ <Check> : Crosstalk of TEST PORT 2

300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -100dB or less
2.6GHz to 3.8GHz : -90dB or less
3.8GHz to 5.0GHz : -80dB or less (R3767CG only)
5.0GHz to 8.0GHz : -70dB or less (R3767CG only)
OPT 12
300kHz to 40MHz : -85dB or less
40MHz to 3.8GHz : -90dB or less

10.8.4 When R3765CG/67CG (OPT 11/OPT 13/OPT 14)

(1) Crosstalk of TEST PORT 1 (When the measurement path is S12)

Testing procedure

① Setup the R3765CG/67CG as follows.

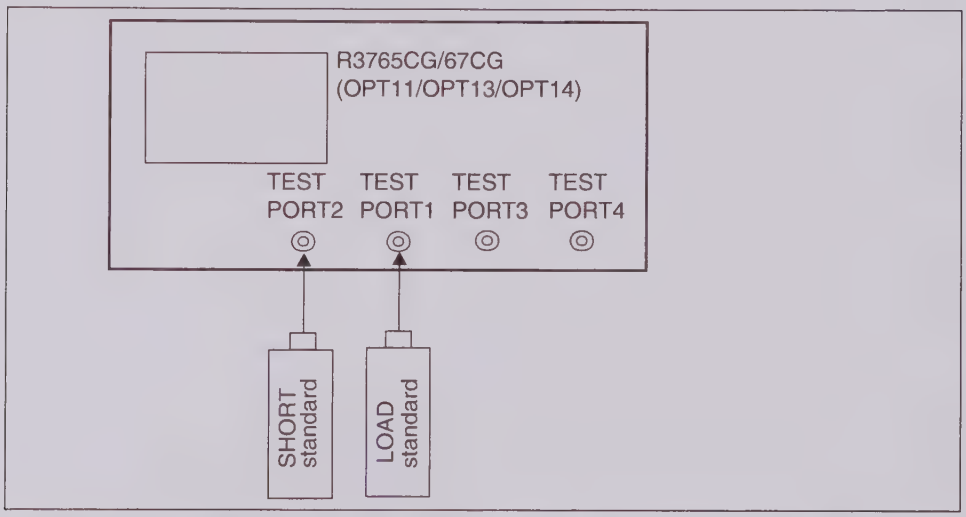


Figure 10-17 Crosstalk of TEST PORT 1 (When the measurement path is S12)

② Setup the R3765CG/67CG.

MEAS : S12
RBW : 100Hz
Average : 16 times

③ Connect the short standard to TEST PORT 2.

④ Connect the load standard to TEST PORT 1.

⑤ Read the crosstalk value of TEST PORT 1 from the trace data.

⑥ <Check> : Crosstalk of TEST PORT 1

OPT 11
300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -100dB or less
2.6GHz to 3.8GHz : -90dB or less
3.8GHz to 5.0GHz : -80dB or less (R3767CG only)
5.0GHz to 8.0GHz : -70dB or less (R3767CG only)

OPT 13
300kHz to 40MHz : -85dB or less
40MHz to 3.8GHz : -90dB or less

OPT 14
300kHz to 40MHz : -85dB or less
40MHz to 2.6GHz : -90dB or less
2.6GHz to 3.8GHz : -85dB or less
3.8GHz to 5.0GHz : -75dB or less (R3767CG only)
5.0GHz to 8.0GHz : -65dB or less (R3767CG only)

(2) Crosstalk of TEST PORT 1 (When the measurement path is S13)

Testing procedure

① Setup the R3765CG/67CG as follows.

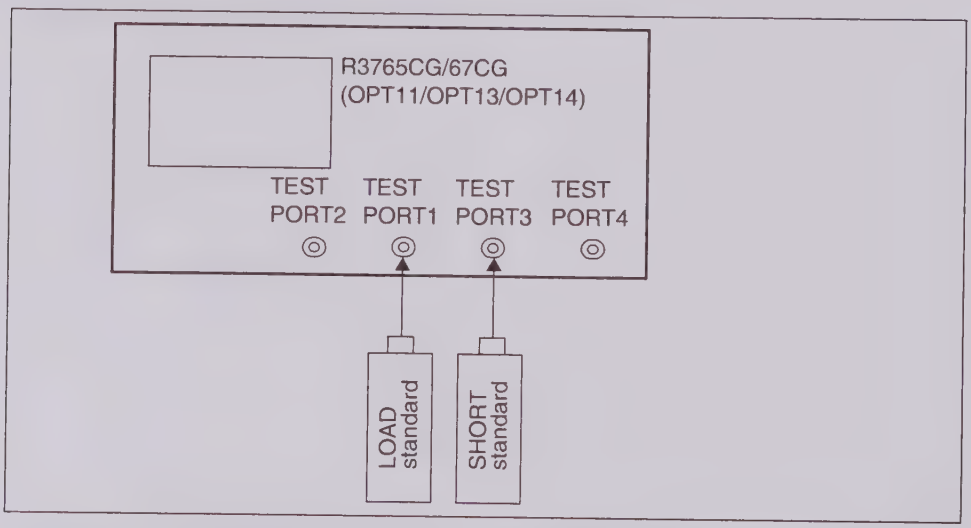


Figure 10-18 Crosstalk of TEST PORT 1 (When the measurement path is S13)

② Setup the R3765CG/67CG.

MEAS : S13
RBW : 100Hz
Average : 16 times

③ Connect the short standard to TEST PORT 3.

④ Connect the load standard to TEST PORT 1.

⑤ Read the crosstalk value of TEST PORT 1 from the trace data.

⑥ <Check> : Crosstalk of TEST PORT 1

OPT 11
300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -100dB or less
2.6GHz to 3.8GHz : -90dB or less
3.8GHz to 5.0GHz : -80dB or less (R3767CG only)
5.0GHz to 8.0GHz : -70dB or less (R3767CG only)

OPT 13
300kHz to 40MHz : -85dB or less
40MHz to 3.8GHz : -90dB or less

OPT 14
300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -95dB or less
2.6GHz to 3.8GHz : -85dB or less
3.8GHz to 5.0GHz : -75dB or less (R3767CG only)
5.0GHz to 8.0GHz : -65dB or less (R3767CG only)

(3) Crosstalk of TEST PORT 1 (When the measurement path is S14) (OPT14)

Testing procedure

① Setup the R3765CG/67CG as follows.

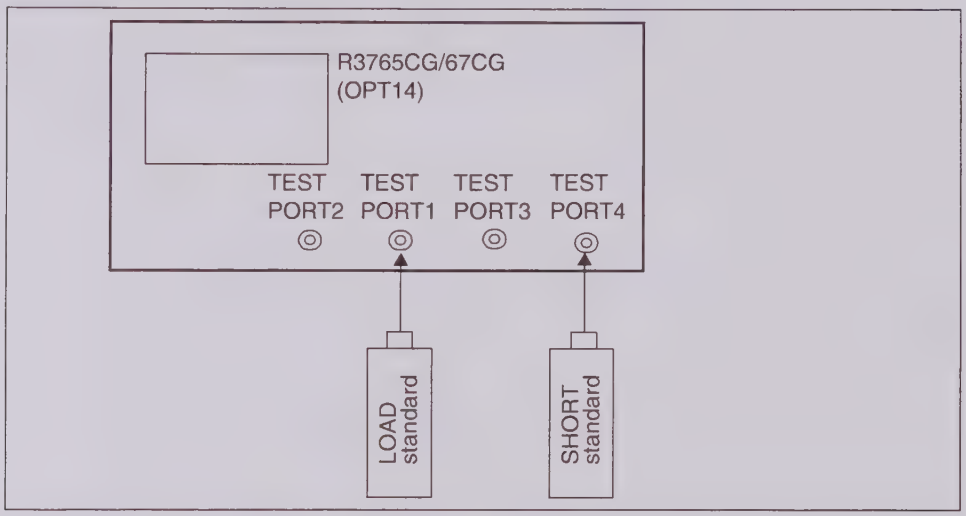


Figure 10-19 Crosstalk of TEST PORT 1 (When the measurement path is S14)

② Setup the R3765CG/67CG.

MEAS : S14
RBW : 100Hz
Average : 16 times

③ Connect the short standard to TEST PORT 4.

④ Connect the load standard to TEST PORT 1.

⑤ Read the crosstalk value of TEST PORT 1 from the trace data.

⑥ <Check> : Crosstalk of TEST PORT 1

300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -95dB or less
2.6GHz to 3.8GHz : -85dB or less
3.8GHz to 5.0GHz : -75dB or less (R3767CG only)
5.0GHz to 8.0GHz : -65dB or less (R3767CG only)

(4) Crosstalk of TEST PORT 2 (When the measurement path is S21)

Testing procedure

① Setup the R3765CG/67CG as follows.

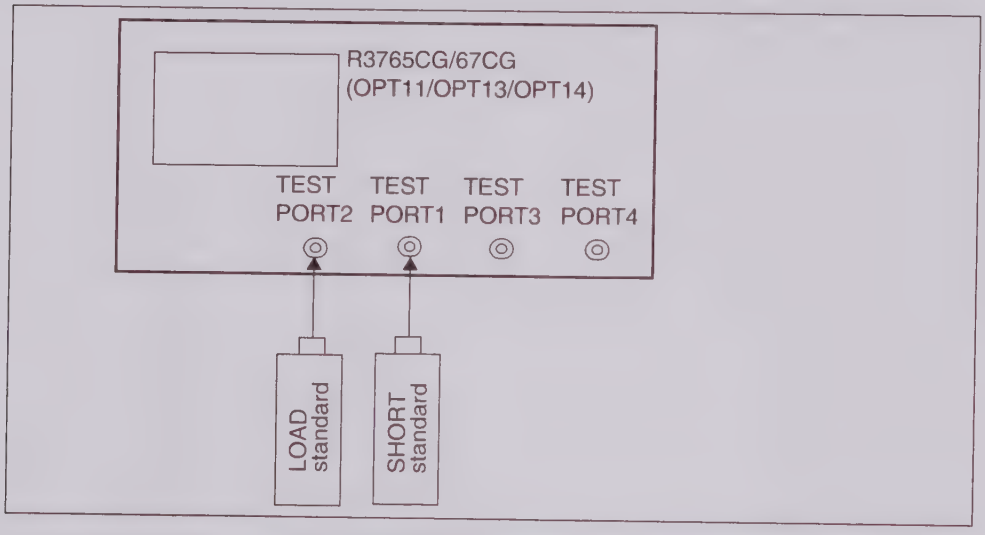


Figure 10-20 Crosstalk of TEST PORT 2 (When the measurement path is S21)

② Setup the R3765CG/67CG.

MEAS : S21
RBW : 100Hz
Average : 16 times

③ Connect the short standard to TEST PORT 1.

④ Connect the load standard to TEST PORT 2.

⑤ Read the crosstalk value of TEST PORT 2 from the trace data.

⑥ <Check> : Crosstalk of TEST PORT 2

OPT 11
300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -100dB or less
2.6GHz to 3.8GHz : -90dB or less
3.8GHz to 5.0GHz : -80dB or less (R3767CG only)
5.0GHz to 8.0GHz : -70dB or less (R3767CG only)

OPT 13
300kHz to 40MHz : -85dB or less
40MHz to 3.8GHz : -90dB or less

OPT 14
300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -95dB or less
2.6GHz to 3.8GHz : -85dB or less
3.8GHz to 5.0GHz : -75dB or less (R3767CG only)
5.0GHz to 8.0GHz : -65dB or less (R3767CG only)

(5) Crosstalk of TEST PORT 2 (When the measurement path is S23)

Testing procedure

① Setup the R3765CG/67CG as follows.

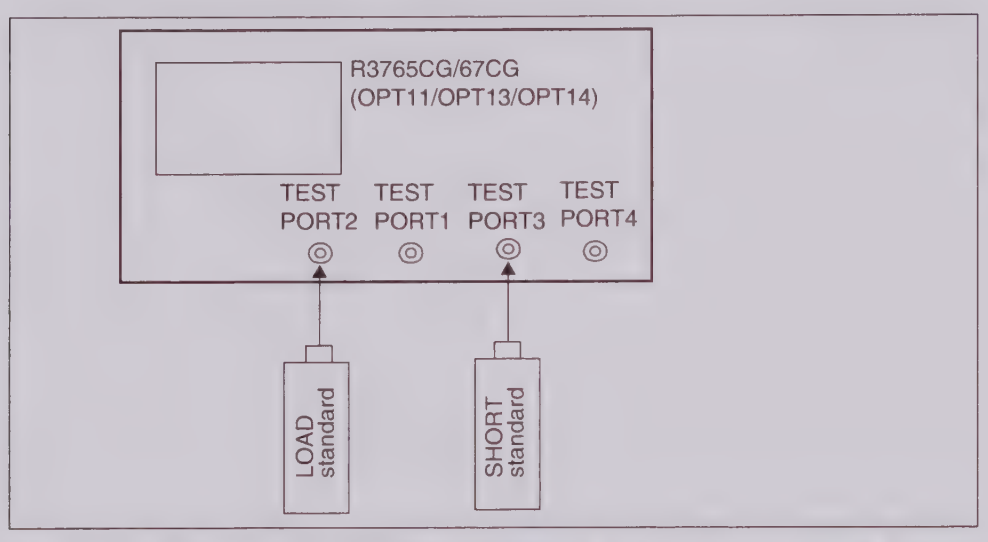


Figure 10-21 Crosstalk of TEST PORT 2 (When the measurement path is S23)

② Setup the R3765CG/67CG.

MEAS : S23
RBW : 100Hz
Average : 16 times

③ Connect the short standard to TEST PORT 3.

④ Connect the load standard to TEST PORT 2.

⑤ Read the crosstalk value of TEST PORT 2 from the trace data.

⑥ <Check> : Crosstalk of TEST PORT 2

OPT 11
300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -100dB or less
2.6GHz to 3.8GHz : -90dB or less
3.8GHz to 5.0GHz : -80dB or less (R3767CG only)
5.0GHz to 8.0GHz : -70dB or less (R3767CG only)

OPT 13
300kHz to 40MHz : -85dB or less
40MHz to 3.8GHz : -90dB or less

OPT 14
300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -95dB or less
2.6GHz to 3.8GHz : -85dB or less
3.8GHz to 5.0GHz : -75dB or less (R3767CG only)
5.0GHz to 8.0GHz : -65dB or less (R3767CG only)

(6) Crosstalk of TEST PORT 2 (When the measurement path is S24) (OPT14)

Testing procedure

① Setup the R3765CG/67CG as follows.

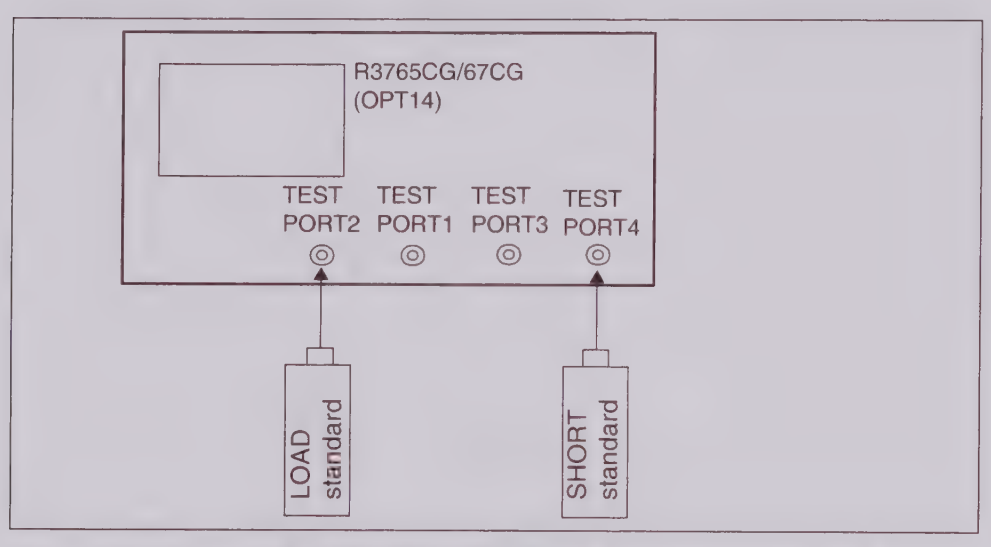


Figure 10-22 Crosstalk of TEST PORT 2 (When the measurement path is S24)

② Setup the R3765CG/67CG.

MEAS : S24
RBW : 100Hz
Average : 16 times

③ Connect the short standard to TEST PORT 4.

④ Connect the load standard to TEST PORT 2.

⑤ Read the crosstalk value of TEST PORT 2 from the trace data.

⑥ <Check> : Crosstalk of TEST PORT 2

300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -95dB or less
2.6GHz to 3.8GHz : -85dB or less
3.8GHz to 5.0GHz : -75dB or less (R3767CG only)
5.0GHz to 8.0GHz : -65dB or less (R3767CG only)

(7) Crosstalk of TEST PORT 3 (When the measurement path is S31)

Testing procedure

① Setup the R3765CG/67CG as follows.

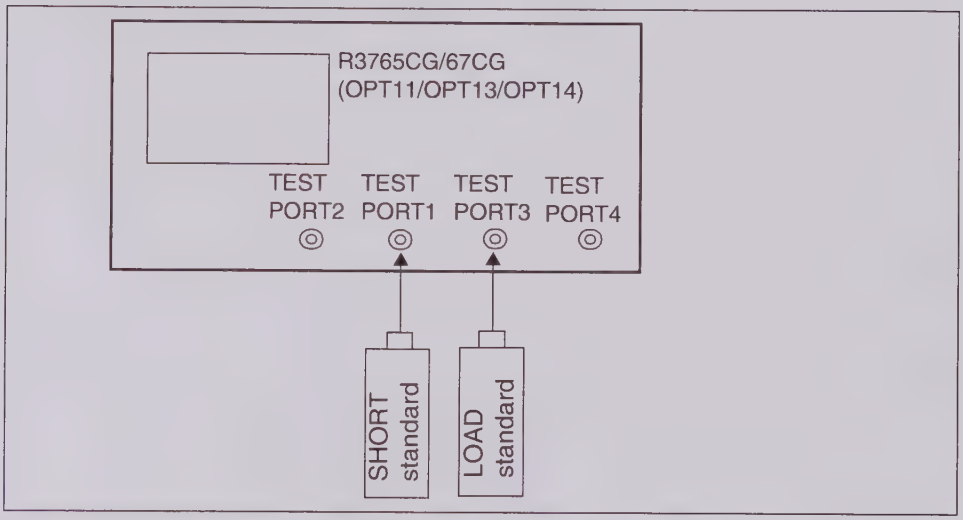


Figure 10-23 Crosstalk of TEST PORT 3 (When the measurement path is S31)

② Setup the R3765CG/67CG.

MEAS : S31
RBW : 100Hz
Average : 16 times

③ Connect the short standard to TEST PORT 1.

④ Connect the load standard to TEST PORT 3.

⑤ Read the crosstalk value of TEST PORT 3 from the trace data.

⑥ <Check> : Crosstalk of TEST PORT 3

OPT 11
300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -100dB or less
2.6GHz to 3.8GHz : -90dB or less
3.8GHz to 5.0GHz : -80dB or less (R3767CG only)
5.0GHz to 8.0GHz : -70dB or less (R3767CG only)

OPT 13
300kHz to 40MHz : -85dB or less
40MHz to 3.8GHz : -90dB or less

OPT 14
300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -95dB or less
2.6GHz to 3.8GHz : -85dB or less
3.8GHz to 5.0GHz : -75dB or less (R3767CG only)
5.0GHz to 8.0GHz : -65dB or less (R3767CG only)

(8) Crosstalk of TEST PORT 3 (When the measurement path is S32)

Testing procedure

① Setup the R3765CG/67CG as follows.

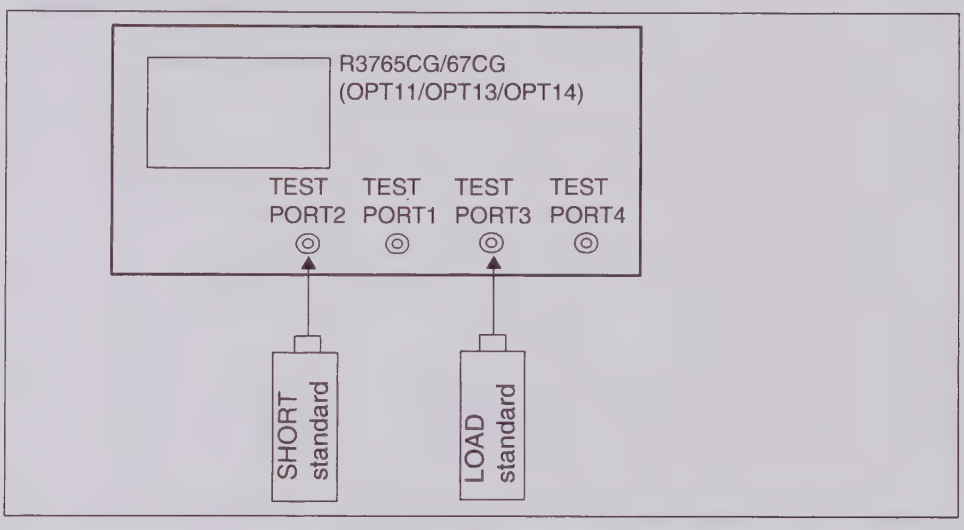


Figure 10-24 Crosstalk of TEST PORT 3 (When the measurement path is S32)

② Setup the R3765CG/67CG.

MEAS : S32
RBW : 100Hz
Average : 16 times

③ Connect the short standard to TEST PORT 2.

④ Connect the load standard to TEST PORT 3.

⑤ Read the crosstalk value of TEST PORT 3 from the trace data.

⑥ <Check> : Crosstalk of TEST PORT 3

OPT 11
300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -100dB or less
2.6GHz to 3.8GHz : -90dB or less
3.8GHz to 5.0GHz : -80dB or less (R3767CG only)
5.0GHz to 8.0GHz : -70dB or less (R3767CG only)

OPT 13
300kHz to 40MHz : -85dB or less
40MHz to 3.8GHz : -90dB or less

OPT 14
300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -95dB or less
2.6GHz to 3.8GHz : -85dB or less
3.8GHz to 5.0GHz : -75dB or less (R3767CG only)
5.0GHz to 8.0GHz : -65dB or less (R3767CG only)

(9) Crosstalk of TEST PORT 3 (When the measurement path is S34) (OPT14)

Testing procedure

① Setup the R3765CG/67CG as follows.

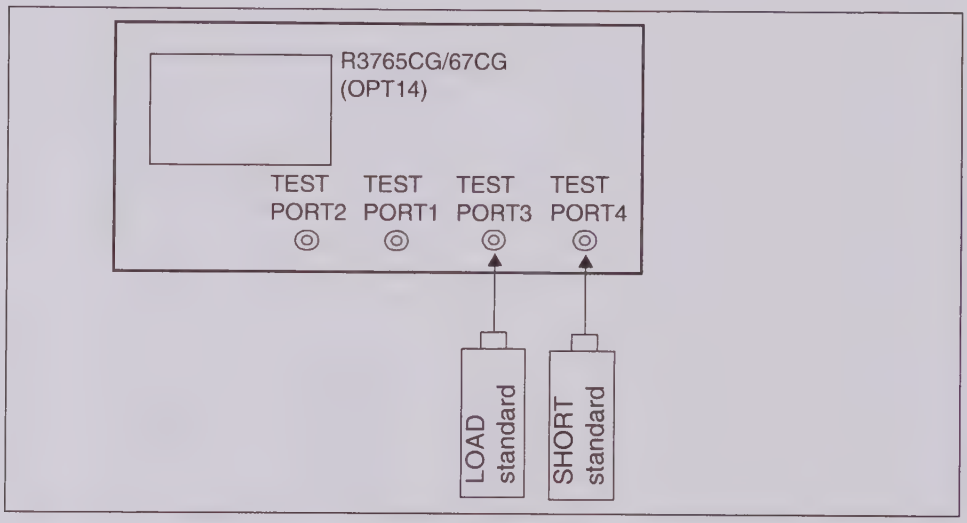


Figure 10-25 Crosstalk of TEST PORT 3 (When the measurement path is S34)

② Setup the R3765CG/67CG.

MEAS : S34
RBW : 100Hz
Average : 16 times

③ Connect the short standard to TEST PORT 4.

④ Connect the load standard to TEST PORT 3.

⑤ Read the crosstalk value of TEST PORT 3 from the trace data.

⑥ <Check> : Crosstalk of TEST PORT 3

300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -95dB or less
2.6GHz to 3.8GHz : -85dB or less
3.8GHz to 5.0GHz : -75dB or less (R3767CG only)
5.0GHz to 8.0GHz : -65dB or less (R3767CG only)

(10) Crosstalk of TEST PORT 4 (When the measurement path is S41) (OPT14)

Testing procedure

① Setup the R3765CG/67CG as follows.

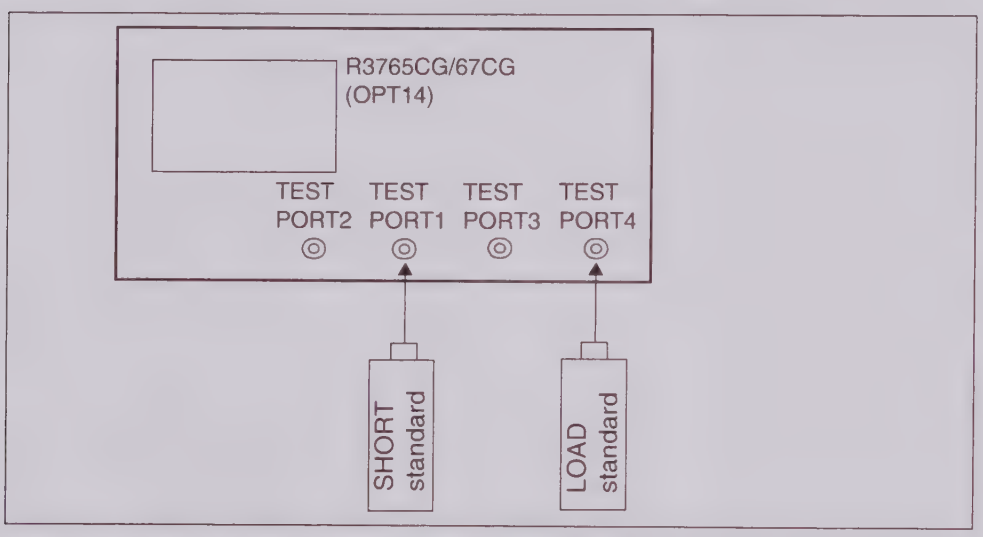


Figure 10-26 Crosstalk of TEST PORT 4 (When the measurement path is S41)

② Setup the R3765CG/67CG.

MEAS : S41
RBW : 100Hz
Average : 16 times

③ Connect the short standard to TEST PORT 1.

④ Connect the load standard to TEST PORT 4.

⑤ Read the crosstalk value of TEST PORT 4 from the trace data.

⑥ <Check> : Crosstalk of TEST PORT 4

300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -95dB or less
2.6GHz to 3.8GHz : -85dB or less
3.8GHz to 5.0GHz : -75dB or less (R3767CG only)
5.0GHz to 8.0GHz : -65dB or less (R3767CG only)

(11) Crosstalk of TEST PORT 4 (When the measurement path is S42) (OPT14)

Testing procedure

① Setup the R3765CG/67CG as follows.

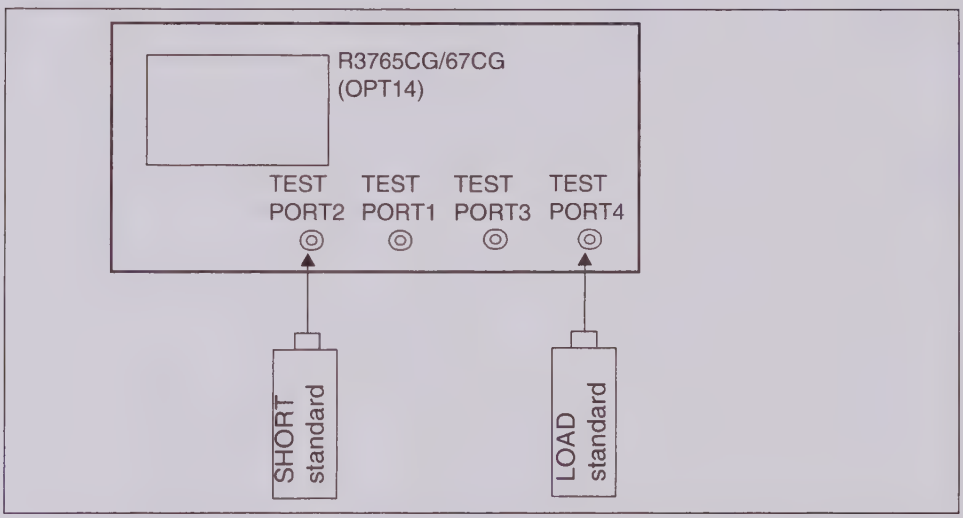


Figure 10-27 Crosstalk of TEST PORT 4 (When the measurement path is S42)

② Setup the R3765CG/67CG.

MEAS : S42
RBW : 100Hz
Average : 16 times

③ Connect the short standard to TEST PORT 2.

④ Connect the load standard to TEST PORT 4.

⑤ Read the crosstalk value of TEST PORT 4 from the trace data.

⑥ <Check> : Crosstalk of TEST PORT 4

300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -95dB or less
2.6GHz to 3.8GHz : -85dB or less
3.8GHz to 5.0GHz : -75dB or less (R3767CG only)
5.0GHz to 8.0GHz : -65dB or less (R3767CG only)

(12) Crosstalk of TEST PORT 4 (When the measurement path is S43) (OPT14)

Testing procedure

① Setup the R3765CG/67CG as follows.

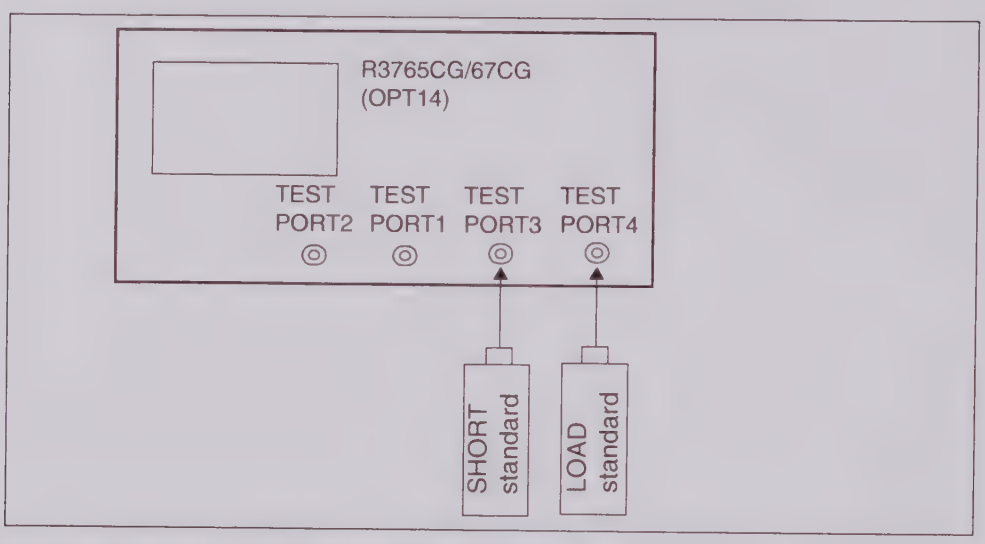


Figure 10-28 Crosstalk of TEST PORT 4 (When the measurement path is S43)

② Setup the R3765CG/67CG.

MEAS : S43
RBW : 100Hz
Average : 16 times

③ Connect the short standard to TEST PORT 3.

④ Connect the load standard to TEST PORT 4.

⑤ Read the crosstalk value of TEST PORT 4 from the trace data.

⑥ <Check> : Crosstalk of TEST PORT 4

300kHz to 40MHz : -90dB or less
40MHz to 2.6GHz : -95dB or less
2.6GHz to 3.8GHz : -85dB or less
3.8GHz to 5.0GHz : -75dB or less (R3767CG only)
5.0GHz to 8.0GHz : -65dB or less (R3767CG only)

10.9 Dynamic Level Accuracy

This section describes how to test the dynamic level accuracy. Since this network analyzer uses the vector detection method, the phase characteristics of the dynamic level accuracy meet the specifications if the magnitude characteristics are within the specifications. For the dynamic level range between 0 dB to -20 dB, the samplers in the input module determines the frequency characteristics.

10.9.1 Dynamic Level Accuracy for the R3765AG/67AG

This section describes the detail test procedure of the dynamic level accuracy. This section applies only to the R3765AG/67AG.

10.9.1.1 Specifications

Reference level : -20 dBm

0 dB to -10 dB : ±0.20 dB (300kHz to 3.8GHz)

0 dB to -10 dB : ±0.40 dB (3.8GHz to 8GHz)

-10 dB to -50 dB : ±0.05 dB

-50 dB to -60 dB : ±0.10 dB

10.9.1.2 Instruments Required

- Step attenuator (Range: 0 to 90 dB, Accuracy within 0.02dB)
  Recommended model: HP8496B
- RF cable (SMA(m)/SMA(m) 50Ω) quantity=2
  Recommended model: A01253-060
- Adopter (N(m)/SMA(f)) quantity=2
  Recommended model: HRM-554S
- 3-dB attenuators (SMA(f)/SMA(m)) quantity=2
  Recommended model: AT-103

10.9.1.3 Procedure

10.9.1.3.1 A PORT Measurement for Dynamic Level Accuracy

(1) Connect two 3-dB attenuators, step attenuator using two RF cables between SOURCE and A PORT shown in Figure 10-29.

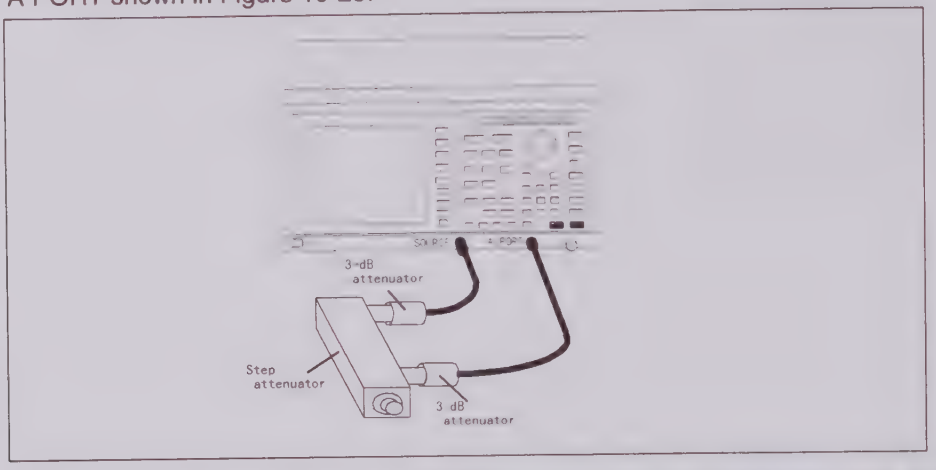


Figure 10-29 Connections for A PORT Measurement for Dynamic Level Accuracy

(2) Press **[MEAS]** and *{A/R}* to set the A PORT measurement mode.

- Dynamic level accuracy at 50 MHz

(3) Press **[CENTER]**, **[5]**, **[0]** and **[MHz]** to set the center frequency to 50 MHz.

(4) Press **[SPAN]**, **[0]**, **[x1]** to set the span to 0 MHz.

(5) Press **[AVG]**, *{IF RBW}*, **[1]**, **[0]**, **[0]** and **[x1]** to set the RBW to 100 Hz.

(6) Press **[MKR]** to set the marker on.

(7) Press **[MENU]**, *{POWER}*, **[6]** and **[x1]** to set the output level to 6 dBm.

(8) Set the step attenuator to 20 dB.

(9) Press **[CAL]** and *{NORMALIZE (THRU)}* to do normalization.

(10) Set the step attenuator to 10 dB.

(11) Read out the marker level.

(12) Repeat steps (10) and (11) on each set level listed on Table 10-2.

Table 10-2 Check Point for the R3765AG/67AG

Setting	Specification
0 dB	±0.20 dB
10 dB	±0.05 dB
20 dB	Reference
30 dB	±0.05 dB
40 dB	±0.05 dB
50 dB	±0.05 dB
60 dB	±0.10 dB

(13) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: ***The offset value is a attenuator error at the reference point.***

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)

- Dynamic level accuracy at 3.8 GHz

(14) Press **[CENTER]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the center frequency to 3.8 GHz.

(15) Press **[MRK]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the marker to 3.8 GHz.

(16) Set the step attenuator to 20 dB.

(17) Press **[CAL]** and *{NORMALIZE(THRU)}* to do normalization.

(18) Set the step attenuator to 10 dB.

(19) Read out the marker level.

(20) Repeat steps (18) and (19) on each setting level listed on Table 10-2.

(21) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: ***The offset value is a attenuator error at the reference point.***

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)

10.9.1.3.2 B PORT Measurement for Dynamic Level Accuracy

(1) Connect two 3-dB attenuator, step attenuator using two RF cables between SOURCE and B PORT shown in Figure 10-30.

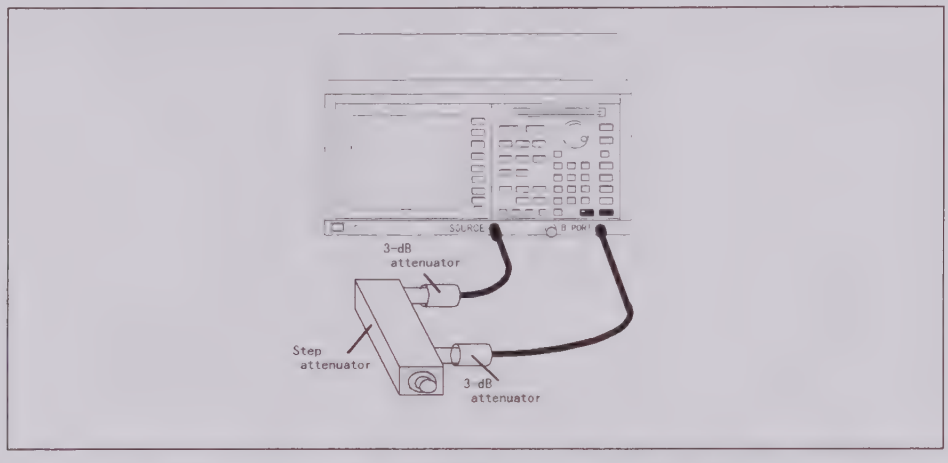


Figure 10-30 Connections for B PORT Measurement for Dynamic Level Accuracy

(2) Press **[MEAS]** and *{B/R}* to set the B PORT measurement mode.

- Dynamic level accuracy at 50 MHz

(3) Press **[CENTER]**, **[5]**, **[0]** and **[MHz]** to set the center frequency to 50 MHz.

(4) Press **[SPAN]**, **[0]** and **[x1]** to set the span to 0 MHz.

(5) Press **[AVG]**, *{IF RBW}*, **[1]**, **[0]**, **[0]** and **[x1]** to set the RBW to 100 Hz.

(6) Press **[MKR]** to set the marker on.

(7) Press **[MENU]**, *{POWER}*, **[6]** and **[x1]** to set the output level to 6 dBm.

(8) Set the step attenuator to 20 dB.

(9) Press **[CAL]** and *{NORMALIZE (THRU)}* to do normalization.

(10) Set the step attenuator to 10 dB.

(11) Read out the marker level.

(12) Repeat steps (10) and (11) on each set level listed on Table 10-2.

(13) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: The offset value is a attenuator error at the reference point.

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)

- Dynamic level accuracy at 3.8 GHz

(14) Press **[CENTER]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the center frequency to 3.8 GHz.

(15) Press **[MRK]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the marker to 3.8 GHz.

(16) Set the step attenuator to 20 dB.

(17) Press **[CAL]** and *{NORMALIZE(THRU)}* to do normalization.

(18) Set the step attenuator to 10 dB.

(19) Read out the marker level.

(20) Repeat steps (19) and (20) on each set level listed on Table 10-2.

(21) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: ***The offset value is a attenuator error at the reference point.***

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)

10.9.2 Dynamic Level Accuracy for the R3765BG/67BG

This section describes the detail test procedure of the dynamic level accuracy. This section applies only to the R3765BG/67BG.

10.9.2.1 Specifications

Reference level :	-19 dBm (-24 dBm for OPT 10, -28 dBm for OPT 10 + OPT 12, -23 dBm for OPT 12)
0 dB to -10 dB :	±0.20 dB (300kHz to 3.8GHz)
0 dB to -10 dB :	±0.40 dB (3.8GHz to 8GHz)
-10 dB to -50 dB :	±0.05 dB
-50 dB to -60 dB :	±0.10 dB

10.9.2.2 Instruments Required

- Step attenuator (Range: 0 to 90 dB, Accuracy within 0.02dB)
  Recommended model: HP8496B
- RF cable (SMA(m)/SMA(m) 50Ω) quantity=2
  Recommended model: A01253-060
- Adopter (N(m)/SMA(f)) quantity=2
  Recommended model: HRM-554S
- 3-dB attenuator (SMA(f)/SMA(m)) quantity=2
  Recommended model: AT-103
- 50Ω to 75Ω conversion adapter (75Ω N(m)/50Ω N(f)) × 2: 11852B (For OPT 12)

10.9.2.3 Procedure

(1) Connect two 3-dB attenuators and step attenuator using two RF cables between TEST PORT 1 and TEST PORT 2 shown in Figure 10-31.

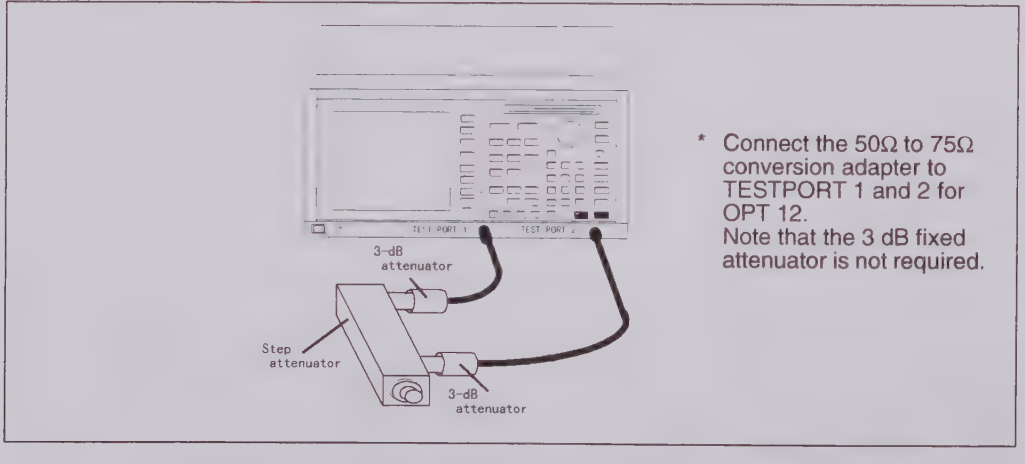

3-dB
attenuator
Step
attenuator
3-dB
attenuator
* Connect the 50Ω to 75Ω conversion adapter to TESTPORT 1 and 2 for OPT 12.
Note that the 3 dB fixed attenuator is not required.

Figure 10-31 Connections for TEST PORT 1 Measurement for Dynamic Level Accuracy

(2) Press **[MEAS]** and *{TRANSMISSION}*.

- Dynamic level accuracy at 50 MHz

(3) Press **[CENTER]**, **[5]**, **[0]** and **[MHz]** to set the center frequency to 50 MHz.

(4) Press **[SPAN]**, **[0]** and **[x1]** to set the span to 0 MHz.

(5) Press **[AVG]**, *{IF RBW}*, **[1]**, **[0]**, **[0]** and **[x1]** to set the RBW to 100 Hz.

(6) Press **[MKR]** to set the marker on.

(7) Press **[MENU]**, *{POWER}*, **[7]** and **[x1]** to set the output level to 7 dBm.
Set a value as shown below according to the options used.

OPT 10: 2 dBm
OPT 10+OPT 12: 4 dBm
OPT 12: 9 dBm

(8) Set the step attenuator to 20 dB.

(9) Press **[CAL]** and *{NORMALIZE (THRU)}* to do normalization

(10) Set the step attenuator to 10 dB.

(11) Read out the marker level.

(12) Repeat steps (10) and (11) on each set level listed on Table 10-3.

Table 10-3 Check Point for the R3765BG/67BG

Setting	Specification
0 dB	±0.20 dB
10 dB	±0.05 dB
20 dB	Reference
30 dB	±0.05 dB
40 dB	±0.05 dB
50 dB	±0.05 dB
60 dB	±0.10 dB

Note: Check between the 0 dB and 50 dB settings for OPT 12.

(13) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: The offset value is a attenuator error at the reference point.

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)

- Dynamic level accuracy at 3.8 GHz

(14) Press **[CENTER]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the center frequency to 3.8 GHz.

(15) Press **[MRK]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the marker to 3.8 GHz.

(16) Set the step attenuator to 20 dB.

(17) Press **[CAL]** and *{NORMALIZE(THRU)}* to do normalization.

(18) Set the step attenuator to 10 dB.

(19) Read out the marker level.

(20) Repeat steps (18) and (19) on each set level listed on the Table 10-3.

(21) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: The offset value is a attenuator error at the reference point.

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)

10.9.3 Dynamic Level Accuracy for the R3765CG/67CG

This section describes the detail test procedure of the dynamic level accuracy. This section applies only to the R3765CG/67CG.

10.9.3.1 Specifications

Reference level :	-16 dBm (-21 dBm for OPT 10, -33 dBm for OPT 10 + OPT 12, -28 dBm for OPT 12)
0 dB to -10 dB :	±0.20 dB (300kHz to 3.8GHz)
0 dB to -10 dB :	±0.40 dB (3.8GHz to 8GHz)
-10 dB to -50 dB :	±0.05 dB
-50 dB to -60 dB :	±0.10 dB

10.9.3.2 Instruments Required

- Step attenuator (Range: 0 to 90 dB, Accuracy within 0.02dB)
  Recommended model: HP8496B
- RF cable (SMA(m)/SMA(m) 50Ω) quantity=2
  Recommended model: A01253-060
- Adopter (N(m)/SMA(f)) quantity=2
  Recommended model: HRM-554S
- 3-dB attenuator (SMA(f)/SMA(m)) quantity=2
  Recommended model: AT-103
- 50Ω to 75Ω conversion adapter (75Ω N(m)/50Ω N(f)) × 2: 11852B (For OPT 12)

10.9.3.3 Procedure

10.9.3.3.1 TEST PORT 2 Measurement for Dynamic Level Accuracy

(1) Connect two 3-dB attenuators and step attenuator using the RF cables between TEST PORT 1 and TEST PORT 2 shown in Figure 10-32.

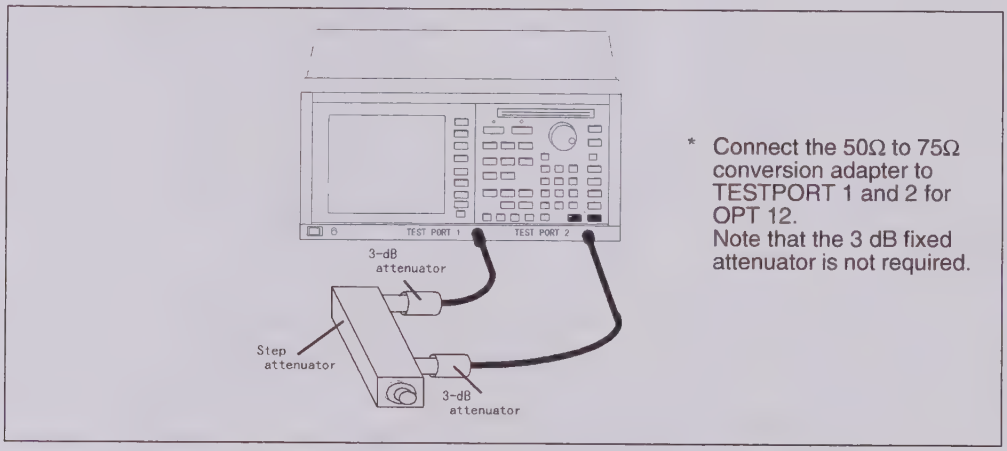

TEST PORT 1
TEST PORT 2
3-dB attenuator
Step attenuator
3-dB attenuator
* Connect the 50Ω to 75Ω conversion adapter to TESTPORT 1 and 2 for OPT 12.
Note that the 3 dB fixed attenuator is not required.

Figure 10-32 Connections for TEST PORT 2 Measurement for Dynamic Level Accuracy

(2) Press **[MEAS]** and *{S21 TRANS FWD}*.

- Dynamic level accuracy at 50 MHz

(3) Press **[CENTER]**, **[5]**, **[0]** and **[MHz]** to set the center frequency to 50 MHz.

(4) Press **[SPAN]**, **[0]** and **[x1]** to set the span to 0 MHz.

(5) Press **[AVG]**, *{IF RBW}*, **[1]**, **[0]**, **[0]** and **[x1]** to set the RBW to 100 Hz.

(6) Press **[MKR]** to set the marker on.

(7) Press **[MENU]**, *{POWER}*, **[1]**, **[0]** and **[x1]** to set the output level to 10 dBm.
Set a value as shown below according to the options used.

OPT 10: 5 dBm
OPT 10+OPT 12: -1 dBm
OPT 12: 4 dBm

(8) Set the step attenuator to 20 dB.

(9) Press **[CAL]** and *{NORMALIZE (THRU)}* to do normalization.

(10) Set the step attenuator to 10 dB.

(11) Read out the marker level.

(12) Repeat steps (10) and (11) on each set level listed on Table 10-4.

Table 10-4 Check Point for the R3765CG/67CG

Setting	Specification
0 dB	±0.20 dB
10 dB	±0.05 dB
20 dB	Reference
30 dB	±0.05 dB
40 dB	±0.05 dB
50 dB	±0.05 dB
60 dB	±0.10 dB

Note: Check between the 0 dB and 50 dB settings for OPT 12.

(13) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: The offset value is a attenuator error at the reference point.

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)

- Dynamic level accuracy at 3.8 GHz

(14) Press **[CENTER]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the center frequency to 3.8 GHz.

(15) Press **[MRK]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the marker to 3.8 GHz.

(16) Set the step attenuator to 20 dB.

(17) Press **[CAL]** and {NORMALIZE(THRU)} to do normalization.

(18) Set the step attenuator to 10 dB.

(19) Read out the marker level.

(20) Repeat steps (18) and (19) on each set level listed on Table 10-4.

(21) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: The offset value is a attenuator error at the reference point.

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)

10.9.3.3.2 TEST PORT 1 Measurement for Dynamic Level Accuracy

(1) Connect two 3-dB attenuators and step attenuator using the RF cables between TEST PORT 1 and TEST PORT 2 shown in Figure 10-33.

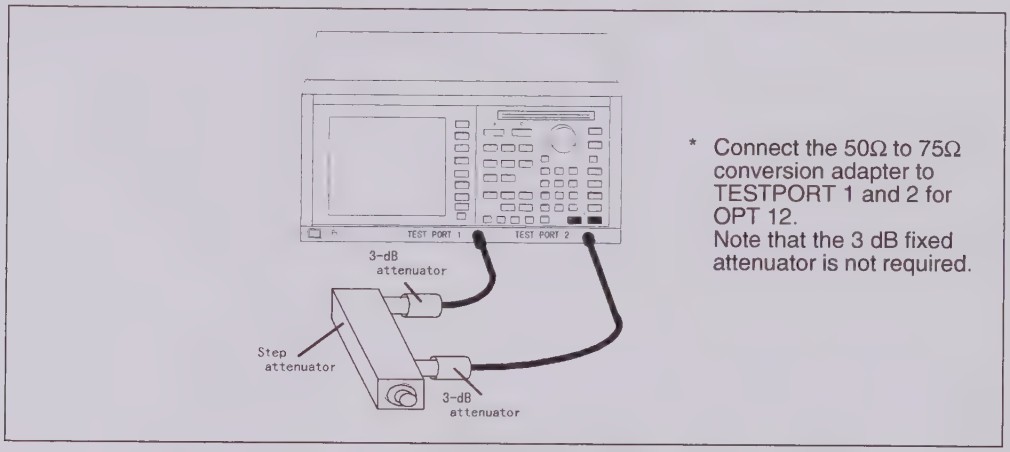

TEST PORT 1
TEST PORT 2
3-dB attenuator
Step attenuator
3-dB attenuator
* Connect the 50Ω to 75Ω conversion adapter to TESTPORT 1 and 2 for OPT 12.
Note that the 3 dB fixed attenuator is not required.

Figure 10-33 Connections for TEST PORT 1 Measurement for Dynamic Level Accuracy

(2) Press **[MEAS]** and *{S12 TRANS REV}*.

- Dynamic level accuracy at 50 MHz

(3) Press **[CENTER]**, **[5]**, **[0]** and **[MHz]** to set the center frequency to 50 MHz.

(4) Press **[SPAN]**, **[0]** and **[x1]** to set the span to 0 MHz.

(5) Press **[AVG]**, *{IF RBW}*, **[1]**, **[0]**, **[0]** and **[x1]** to set the RBW to 100 Hz.

(6) Press **[MKR]** to set the marker on.

(7) Press **[MENU]**, *{POWER}*, **[1]**, **[0]** and **[x1]** to set the output level to 10 dBm. Set a value as shown below according to the options used.

OPT 10:	5 dBm
OPT 10+OPT 12:	-1 dBm
OPT 12:	4 dBm

(8) Set the step attenuator to 20 dB.

(9) Press **[CAL]** and *{NORMALIZE (THRU)}* to do normalization.

(10) Set the step attenuator to 10 dB.

(11) Read out the marker level.

(12) Repeat steps (10) and (11) on each set level listed on Table 10-4.

(13) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: The offset value is a attenuator error at the reference point.

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)

- Dynamic level accuracy at 3.8 GHz

(14) Press **[CENTER]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the center frequency to 3.8 GHz.

(15) Press **[MRK]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the marker to 3.8 GHz.

(16) Set the step attenuator to 20 dB.

(17) Press **[CAL]** and *{NORMALIZE(THRU)}* to do normalization.

(18) Set the step attenuator to 10 dB.

(19) Read out the marker level.

(20) Repeat steps (18) and (19) on each set level listed on Table 10-4.

(21) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: The offset value is a attenuator error at the reference point.

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)Power Up Self Test

10.9.4 Dynamic Level Accuracy for the R3765CG/67CG (OPT11/OPT13/OPT14)

This section describes the detail test procedure of the dynamic level accuracy. This section applies only to the R3765CG/67CG (OPT11/OPT14).

10.9.4.1 Specifications

Reference level :	-16 dBm (-21 dBm for OPT 10 + OPT 11 or OPT 14, -33 dBm for OPT 10 + OPT13, -28 dBm for OPT 13)
0 dB to -10 dB :	±0.20 dB (300kHz to 3.8GHz)
0 dB to -10 dB :	±0.40 dB (3.8GHz to 8GHz)
-10 dB to -50 dB :	±0.05 dB
-50 dB to -60 dB :	±0.10 dB

10.9.4.2 Instruments Required

- Step attenuator (Range: 0 to 90 dB, Accuracy within 0.02dB)
  Recommended model: HP8496B
- RF cable (SMA(m)/SMA(m) 50Ω) quantity=2
  Recommended model: A01253-060
- Adopter (N(m)/SMA(f)) quantity=2
  Recommended model: HRM-554S
- 3-dB attenuator (SMA(f)/SMA(m)) quantity=2
  Recommended model: AT-103
- 50Ω to 75Ω conversion adapter (75Ω N(m)/50Ω N(f)) × 2: 11852B (For OPT 13)

10.9.4.3 Procedure

10.9.4.3.1 TEST PORT 2 Measurement for Dynamic Level Accuracy

(1) Connect two 3-dB attenuators and step attenuator using the RF cables between TEST PORT 2 and TEST PORT 3 shown in Figure 10-34.

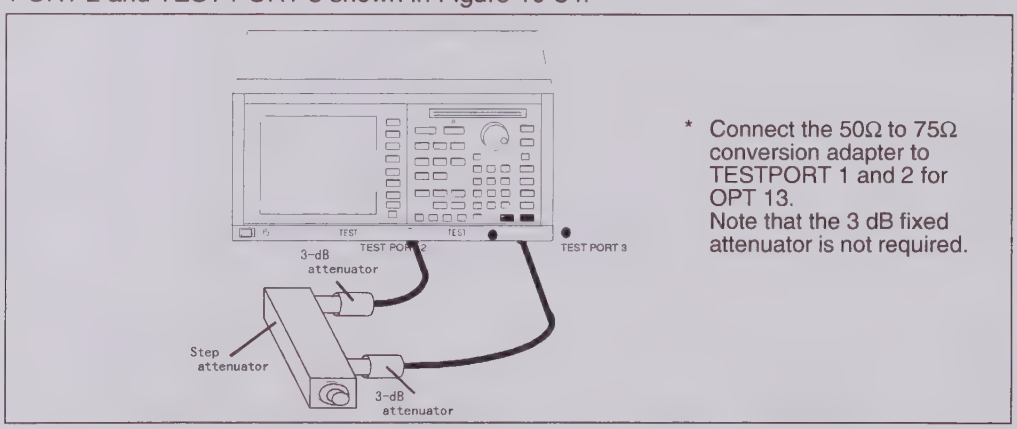

TEST
TEST
TEST PORT 3
3-dB attenuator
Step attenuator
3-dB attenuator
* Connect the 50Ω to 75Ω conversion adapter to TESTPORT 1 and 2 for OPT 13.
Note that the 3 dB fixed attenuator is not required.

Figure 10-34 Connections for TEST PORT 2 Measurement for Dynamic Level Accuracy

(2) Press **[MEAS]** and *{S23 (P2 ← P3)}*.

- Dynamic level accuracy at 50 MHz

(3) Press **[CENTER]**, **[5]**, **[0]** and **[MHz]** to set the center frequency to 50 MHz.

(4) Press **[SPAN]**, **[0]** and **[x1]** to set the span to 0 MHz.

(5) Press **[AVG]**, *{IF RBW}*, **[1]**, **[0]**, **[0]** and **[x1]** to set the RBW to 100 Hz.

(6) Press **[MKR]** to set the marker on.

(7) Press **[MENU]**, *{POWER}*, **[1]**, **[0]** and **[x1]** to set the output level to 10 dBm. Set a value as shown below according to the options used.

OPT 10+OPT 11 or OPT 14: 5 dBm
OPT 10+OPT 13: -1 dBm
OPT 13: 4 dBm

(8) Set the step attenuator to 20 dB.

(9) Press **[CAL]** and *{NORMALIZE (THRU)}* to do normalization.

(10) Set the step attenuator to 10 dB.

(11) Read out the marker level.

(12) Repeat steps (10) and (11) on each set level listed on Table 10-4.

Table 10-5 Check Point for the R3765CG/67CG (For OPT 11, OPT 13 and OPT 14)

Setting	Specification
0 dB	±0.20 dB
10 dB	±0.05 dB
20 dB	Reference
30 dB	±0.05 dB
40 dB	±0.05 dB
50 dB	±0.05 dB
60 dB	±0.10 dB

Note: Check between the 0 dB and 50 dB settings for OPT 13.

(13) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: The offset value is a attenuator error at the reference point.

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)

- Dynamic level accuracy at 3.8 GHz

(14) Press **[CENTER]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the center frequency to 3.8 GHz.

(15) Press **[MRK]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the marker to 3.8 GHz.

(16) Set the step attenuator to 20 dB.

(17) Press **[CAL]** and *{NORMALIZE(THRU)}* to do normalization.

(18) Set the step attenuator to 10 dB.

(19) Read out the marker level.

(20) Repeat steps (18) and (19) on each set level listed on Table 10-4.

(21) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: The offset value is a attenuator error at the reference point.

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)

10.9.4.3.2 TEST PORT 1 Measurement for Dynamic Level Accuracy

(1) Connect two 3-dB attenuators and step attenuator using the RF cables between TEST PORT 1 and TEST PORT 2 shown in Figure 10-35.

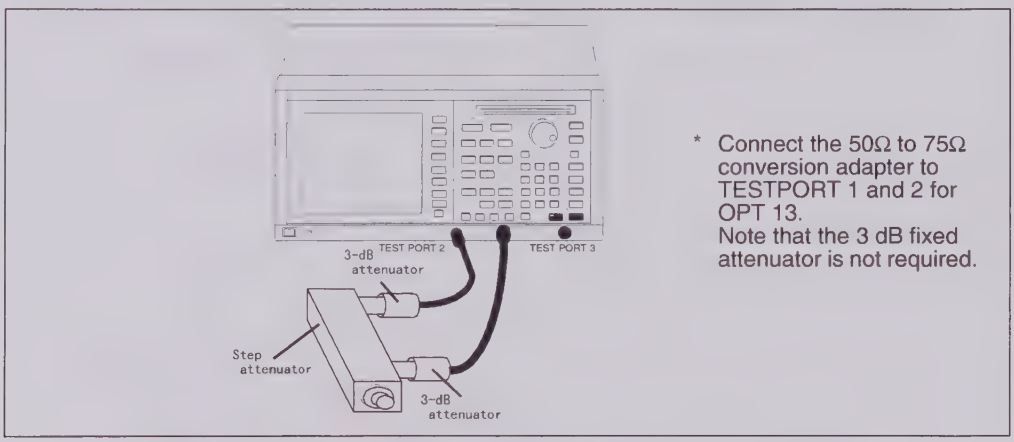

3-dB attenuator
TEST PORT 2
TEST PORT 3
Step attenuator
3-dB attenuator
* Connect the 50Ω to 75Ω conversion adapter to TESTPORT 1 and 2 for OPT 13.
Note that the 3 dB fixed attenuator is not required.

Figure 10-35 Connections for TEST PORT 1 Measurement for Dynamic Level Accuracy

(2) Press **[MEAS]** and *{S12 (P2 → P1)}*.

- Dynamic level accuracy at 50 MHz

(3) Press **[CENTER]**, **[5]**, **[0]** and **[MHz]** to set the center frequency to 50 MHz.

(4) Press **[SPAN]**, **[0]** and **[x1]** to set the span to 0 MHz.

(5) Press **[AVG]**, *{IF RBW}*, **[1]**, **[0]**, **[0]** and **[x1]** to set the RBW to 100 Hz.

(6) Press **[MKR]** to set the marker on.

(7) Press **[MENU]**, *{POWER}*, **[1]**, **[0]** and **[x1]** to set the output level to 10 dBm.
Set a value as shown below according to the options used.

OPT 10+OPT 11 or OPT 14:	5 dBm
OPT 10+OPT 13:	-1 dBm
OPT 13:	4 dBm

(8) Set the step attenuator to 20 dB.

(9) Press **[CAL]** and *{NORMALIZE (THRU)}* to do normalization.

(10) Set the step attenuator to 10 dB.

(11) Read out the marker level.

(12) Repeat steps (10) and (11) on each set level listed on Table 10-5.

(13) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: The offset value is a attenuator error at the reference point.

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)

- Dynamic level accuracy at 3.8 GHz

(14) Press **[CENTER]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the center frequency to 3.8 GHz.

(15) Press **[MRK]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the marker to 3.8 GHz.

(16) Set the step attenuator to 20 dB.

(17) Press **[CAL]** and *{NORMALIZE(THRU)}* to do normalization.

(18) Set the step attenuator to 10 dB.

(19) Read out the marker level.

(20) Repeat steps (18) and (19) on each set level listed on Table 10-5.

(21) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: The offset value is a attenuator error at the reference point.

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)Power Up Self Test

10.9.4.3.3 TEST PORT 3 Measurement for Dynamic Level Accuracy

(1) Connect two 3-dB attenuators and step attenuator using the RF cables between TEST PORT 2 and TEST PORT 3 shown in Figure 10-36.

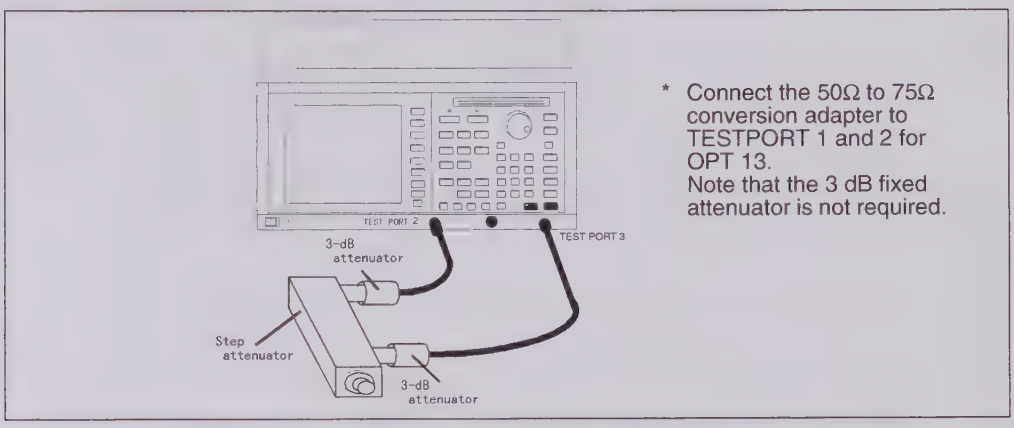

TEST PORT 2
TEST PORT 3
3-dB attenuator
Step attenuator
3-dB attenuator
* Connect the 50Ω to 75Ω conversion adapter to TESTPORT 1 and 2 for OPT 13.
Note that the 3 dB fixed attenuator is not required.

Figure 10-36 Connections for TEST PORT 3 Measurement for Dynamic Level Accuracy

(2) Press **[MEAS]** and *{S32 (P2 → P3)}*.

- Dynamic level accuracy at 50 MHz

(3) Press **[CENTER]**, **[5]**, **[0]** and **[MHz]** to set the center frequency to 50 MHz.

(4) Press **[SPAN]**, **[0]** and **[x1]** to set the span to 0 MHz.

(5) Press **[AVG]**, *{IF RBW}*, **[1]**, **[0]**, **[0]** and **[x1]** to set the RBW to 100 Hz.

(6) Press **[MKR]** to set the marker on.

(7) Press **[MENU]**, *{POWER}*, **[1]**, **[0]** and **[x1]** to set the output level to 10 dBm.
Set a value as shown below according to the options used.

OPT 10+OPT 11 or OPT 14:	5 dBm
OPT 10+OPT 13:	-1 dBm
OPT 13:	4 dBm

(8) Set the step attenuator to 20 dB.

(9) Press **[CAL]** and *{NORMALIZE (THRU)}* to do normalization.

(10) Set the step attenuator to 10 dB.

(11) Read out the marker level.

(12) Repeat steps (10) and (11) on each set level listed on Table 10-5.

(13) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: The offset value is a attenuator error at the reference point.

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)

- Dynamic level accuracy at 3.8 GHz

(14) Press **[CENTER]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the center frequency to 3.8 GHz.

(15) Press **[MRK]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the marker to 3.8 GHz.

(16) Set the step attenuator to 20 dB.

(17) Press **[CAL]** and *{NORMALIZE(THRU)}* to do normalization.

(18) Set the step attenuator to 10 dB.

(19) Read out the marker level.

(20) Repeat steps (18) and (19) on each set level listed on Table 10-5.

(21) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: The offset value is a attenuator error at the reference point.

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)Power Up Self Test

10.9.4.3.4 TEST PORT 4 Measurement for Dynamic Level Accuracy (For OPT 14)

(1) Connect two 3-dB attenuators and step attenuator using the RF cables between TEST PORT 2 and TEST PORT 4 shown in Figure 10-37.

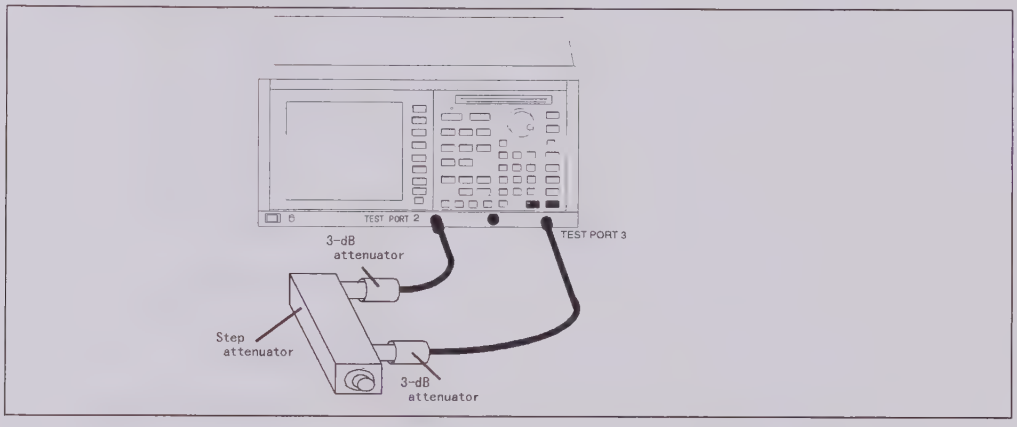


Figure 10-37 Connections for TEST PORT 4 Measurement for Dynamic Level Accuracy

(2) Press **[MEAS]** and *{S42 (P2 → P4)}*.

- Dynamic level accuracy at 50 MHz

(3) Press **[CENTER]**, **[5]**, **[0]** and **[MHz]** to set the center frequency to 50 MHz.

(4) Press **[SPAN]**, **[0]** and **[x1]** to set the span to 0 MHz.

(5) Press **[AVG]**, *{IF RBW}*, **[1]**, **[0]**, **[0]** and **[x1]** to set the RBW to 100 Hz.

(6) Press **[MKR]** to set the marker on.

(7) Press **[MENU]**, *{POWER}*, **[1]**, **[0]** and **[x1]** to set the output level to 10 dBm.

(8) Set the step attenuator to 20 dB.

(9) Press **[CAL]** and *{NORMALIZE (THRU)}* to do normalization.

(10) Set the step attenuator to 10 dB.

(11) Read out the marker level.

(12) Repeat steps (10) and (11) on each set level listed on Table 10-5.

(13) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: The offset value is a attenuator error at the reference point.

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)

- Dynamic level accuracy at 3.8 GHz

(14) Press **[CENTER]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the center frequency to 3.8 GHz.

(15) Press **[MRK]**, **[3]**, **[.]**, **[8]** and **[GHz]** to set the marker to 3.8 GHz.

(16) Set the step attenuator to 20 dB.

(17) Press **[CAL]** and *{NORMALIZE(THRU)}* to do normalization.

(18) Set the step attenuator to 10 dB.

(19) Read out the marker level.

(20) Repeat steps (18) and (19) on each set level listed on Table 10-5.

(21) For each set level, calculate the dynamic level error using the following formula:
(dynamic level error) = (measured value) - (Offset value)

NOTE: ***The offset value is a attenuator error at the reference point.***

(Offset value)=(calibration factor of the attenuator at the reference point)-(calibration factor of the attenuator at the set level)Power Up Self Test

10.10 Attenuation Accuracy (OPT10)

10.10.1 Specifications

Reference Level: Attenuation 0dB
Attenuation 20dB : ±4dB
Attenuation 40dB : ±5dB
Attenuation 60dB : ±6dB

10.10.2 Instruments Required

- RF cable (SMA(m)/SMA(m) 50Ω)
  Recommended model : A01253-060
- Adopter (N(m)/SMA(f)) quantity=2
  Recommended model : HRM-554S
- RF cable (N(m)/N(m) 75Ω) (For OPT 12 or 13)
  Recommended model : 8120-6468

10.10.3 Testing Procedure

(1) Connect the RF cable and conversion connector (for OPT 12 or 13, only the RF cable is used) from TEST PORT 1 to TEST PORT 2 as shown in Figure 10-38.

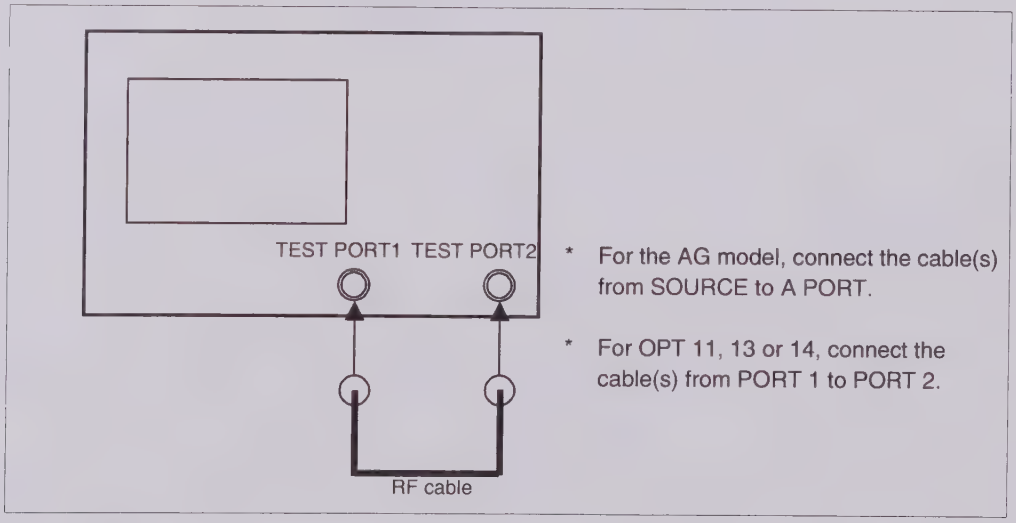

TEST PORT1
TEST PORT2
RF cable
* For the AG model, connect the cable(s) from SOURCE to A PORT.
* For OPT 11, 13 or 14, connect the cable(s) from PORT 1 to PORT 2.

Figure 10-38 Connections for Attenuation Accuracy Measurements

(2) Press **[MEAS]** and *{A/R}* (for the AG model).
Press **[MEAS]** and *{TRANSMISSION}* (for the BG model).
Press **[MEAS]** and *{S21 TRANS FWD}* (for the CG model).

(3) Press **[MENU]**, *{POWER}*, *{ATT MODE AUTO/FIX}*, *{FIX}* and *{RETURN}*.
The output level and attenuation are set.

(4) Press **[MENU]**, *{POWER}*, **[-]**, **[1]** and **[X1]**.
The output level is set to -1 dBm.

(5) Press **[SCALE]**, *{/DIV}*, **[1]**, **[0]** and **[X1]**.
The scale is set to 10 dB/DIV.

(6) Press **[AVG]**, *{IF RBW}*, **[1]**, **[0]** and **[X1]**.
The RBW is set to 10 Hz.

(7) Press **[MKR]**.
A marker is displayed.

(8) Press **[CAL]** and *{NORMALIZE(THRU)}*.
A normalization operation is set.

(9) Press **[MENU]**, *{POWER}*, *{ATTENUATION PORT 1}*, **[2]**, **[0]**, **[X1]** and *{RETURN}*.
The attenuator is set to 20 dB.

(10) Wait until the sweep is completed.

(11) Press **[MRK→]**, *{MKR SEARCH[]}* and *{MAX}*.
The maximum marker level is read.

(12) Press **[MRK→]**, *{MKR SEARCH[]}*, *{MIN}* and *{RETURN}*.
The minimum marker level is read.

(13) Press **[MENU]**, *{POWER}*, *{ATTENUATION PORT 1}*, **[4]**, **[0]**, **[X1]** and *{RETURN}*.
The attenuator is set to 40 dB.

(14) Repeat steps (10) thru (12) to read the marker levels.

(15) Press **[MENU]**, *{POWER}*, *{ATTENUATION PORT 1}*, **[6]**, **[0]**, **[X1]** and *{RETURN}*.
The attenuator is set to 60 dB.

(16) Repeat steps (10) thru (12) to read the marker levels.

11 SPECIFICATIONS

This chapter describes about the function of the R3765/67G series and the performance/specification together.

(1) Measurement Function

Sweep channel	2 channels (CH1, CH2)	
Display channel	4 channels (CH1, CH2, CH3, CH4)	
Trace	2 traces/channels (Up to 8 traces can be displayed simultaneously)	
Measurement parameter	R3765CG/67CG:	S11, S21, S12, S22
	OPT11, 13:	S11, S22, S33, S21, S12, S31, S13, S23, S32
	OPT14:	S11, S22, S33, S44, S21, S31, S41, S12, S32, S42, S13, S23, S43, S14, S24, S34
	R3765BG/67BG:	TRANSMISSION, REFLECTION
	R3765AG/67AG:	A/R, B/R
	These parameters can be converted into impedance (Z) or admittance (Y).	
Measurement format		
Rectangular display	The real part and the imaginary part of logarithmic/linear magnitude, phase, group-delay, VSWR or complex number.	
Smith chart	Reading with marker is for logarithmic/linear magnitude & phase, real part + imaginary part, R + jX, G + jB.	
Polar coordinates display	Reading with marker is for logarithmic/linear magnitude & phase, real part + imaginary part.	

(2) Signal Source Section

Frequency	
Range	R3765AG/BG/CG: 300kHz - 3.8GHz R3767AG/BG/CG: 300kHz - 8GHz
Setting resolution	1Hz
Measurement resolution	±0.01ppm
Accuracy	±10ppm (23°C ± 5°C)
Stability against temperature changes	±7.5ppm (0 to 55°C, Typical value)
Aging	±3ppm (Year, Typical value)
Output power	
Range	R3765CG/67CG: +10dBm to -10dBm For OPT 12 or OPT 13 +4dBm to -16dBm For OPT 14 +8dBm to -10dBm For OPT 10 or OPT 10+OPT 11 +5dBm to -15dBm (ATT FIX) +5dBm to -75dBm (ATT AUTO) For OPT 10+OPT 12 or OPT 10+OPT 13 -1dBm to -21dBm (ATT FIX) -1dBm to -81dBm (ATT AUTO) For OPT 10+OPT 14 +3dBm to -15dBm (ATT FIX) +3dBm to -75dBm (ATT AUTO) R3765BG/67BG: +7dBm to -13dBm For OPT 12 +9dBm to -11dBm (ATT FIX) For OPT 10 +2dBm to -18dBm (ATT FIX) +2dBm to -78dBm (ATT AUTO) For OPT 10+OPT 12 +4dBm to -16dBm (ATT FIX) +4dBm to -76dBm (ATT AUTO) R3765AG/67AG: +17dBm to -3dBm For OPT 10 +12dBm to -8dBm (ATT FIX) +12dBm to -68dBm (ATT AUTO)
Resolution	0.01dB

(Continued)

Accuracy	R3765CG/67CG: ±0.5dB (50MHz, 0dBm, 23°C ± 5°C) For OPT 10, OPT 10+OPT 11 or OPT 10+OPT 14 ±0.5dB (50MHz, -5dBm, 23°C ± 5°C) For OPT 12 or OPT 13 ±0.5dB (50MHz, -6dBm, 23°C ± 5°C) For OPT 10+OPT 12 or OPT 10+OPT 13 ±0.5dB (50MHz, -11dBm, 23°C ± 5°C) For OPT 11, 13 or 14, the accuracy is specified using TEST PORT 1. If OPT 10 is installed, the accuracy is specified using an attenuation of 0 dB. R3765BG/67BG: ±0.5dB (50MHz, -3dBm, 23°C ± 5°C) For OPT 10 ±0.5dB (50MHz, -8dBm, 23°C ± 5°C) For OPT 12 ±0.5dB (50MHz, -1dBm, 23°C ± 5°C) For OPT 10+OPT 12 ±0.5dB (50MHz, -6dBm, 23°C ± 5°C) If OPT 10 is installed, the accuracy is specified using an attenuation of 0 dB. R3765AG/67AG: ±0.5dB (50MHz, 7dBm, 23°C ± 5°C) For OPT 10 ±0.5dB (50MHz, +2dBm, 23°C ± 5°C) If OPT 10 is installed, the accuracy is specified using an attenuation of 0 dB.
Flatness	2.0dBp-p (23°C ± 5°C) For OPT 11, 13 or 14, the accuracy is specified using TEST PORT 1.

(Continued)

Linearity	R3765CG/67CG: 300kHz to 15MHz ±0.4dB (-5dBm to +5dBm, 0dBm reference 23°C ± 5°C) ±0.8dB (-10dBm to +10dBm, 0dBm reference 23°C ± 5°C) 15MHz to 8GHz ±0.2dB (-5dBm to +5dBm, 0dBm reference 23°C ± 5°C) ±0.4dB (-10dBm to +10dBm, 0dBm reference 23°C ± 5°C) For OPT 10 or OPT 10+OPT 11 300kHz to 15MHz ±0.6dB (-10dBm to 0dBm, -5dBm reference 23°C ± 5°C) ±1.3dB (-15dBm to +5dBm, -5dBm reference 23°C ± 5°C) 15MHz to 8GHz ±0.4dB (-10dBm to 0dBm, -5dBm reference 23°C ± 5°C) ±0.6dB (-15dBm to +5dBm, -5dBm reference 23°C ± 5°C) For OPT 12 or 13 300kHz to 15MHz ±0.4dB (-11dBm to -1dBm, -6dBm reference 23°C ± 5°C) ±0.8dB (-16dBm to +4dBm, -6dBm reference 23°C ± 5°C) 15MHz to 3.8GHz ±0.2dB (-11dBm to -1dBm, -6dBm reference 23°C ± 5°C) ±0.4dB (-16dBm to +4dBm, -6dBm reference 23°C ± 5°C) For OPT 14 300kHz to 15MHz ±0.4dB (-5dBm to +5dBm, 0dBm reference 23°C ± 5°C) ±0.8dB (-10dBm to +8dBm, 0dBm reference 23°C ± 5°C) 15MHz to 8GHz ±0.2dB (-5dBm to +5dBm, 0dBm reference 23°C ± 5°C) ±0.4dB (-10dBm to +8dBm, 0dBm reference 23°C ± 5°C) For OPT 10+OPT 12 or OPT 10+OPT 13 300kHz to 15MHz ±0.6dB (-16dBm to -6dBm, -11dBm reference 23°C ± 5°C) ±1.3dB (-21dBm to -1dBm, -11dBm reference 23°C ± 5°C) 15MHz to 3.8GHz ±0.4dB (-16dBm to -6dBm, -11dBm reference 23°C ± 5°C) ±0.6dB (-21dBm to -1dBm, -11dBm reference 23°C ± 5°C) For OPT 10+OPT 14 300kHz to 15MHz ±0.6dB (-10dBm to 0dBm, -5dBm reference 23°C ± 5°C) ±1.3dB (-15dBm to +3dBm, -5dBm reference 23°C ± 5°C) 15MHz to 8GHz ±0.4dB (-10dBm to 0dBm, -5dBm reference 23°C ± 5°C) ±0.6dB (-15dBm to +3dBm, -5dBm reference 23°C ± 5°C) If OPT 10 is installed, the accuracy is specified using an attenuation of 0 dB.

(Continued)

	R3765BG/67BG: 300kHz to 15MHz ±0.4dB (-8dBm to +2dBm, -3dBm reference 23°C ± 5°C) ±0.8dB (-13dBm to +7dBm, -3dBm reference 23°C ± 5°C) 15MHz to 8GHz ±0.2dB (-8dBm to +2dBm, -3dBm reference 23°C ± 5°C) ±0.4dB (-13dBm to +7dBm, -3dBm reference 23°C ± 5°C) For OPT 10 300kHz to 15MHz ±0.6dB (-13dBm to -3dBm, -8dBm reference 23°C ± 5°C) ±1.3dB (-18dBm to +2dBm, -8dBm reference 23°C ± 5°C) 15MHz to 8GHz ±0.4dB (-13dBm to -3dBm, -8dBm reference 23°C ± 5°C) ±0.6dB (-18dBm to +2dBm, -8dBm reference 23°C ± 5°C) For OPT 12 300kHz to 15MHz ±0.4dB (-6dBm to +4dBm, -1dBm reference 23°C ± 5°C) ±0.8dB (-11dBm to +9dBm, -1dBm reference 23°C ± 5°C) 15MHz to 3.8GHz ±0.2dB (-6dBm to +4dBm, -1dBm reference 23°C ± 5°C) ±0.4dB (-11dBm to +9dBm, -1dBm reference 23°C ± 5°C) For OPT 10+OPT 12 300kHz to 15MHz ±0.6dB (-11dBm to -1dBm, -6dBm reference 23°C ± 5°C) ±1.3dB (-16dBm to +4dBm, -6dBm reference 23°C ± 5°C) 15MHz to 3.8GHz ±0.4dB (-11dBm to -1dBm, -6dBm reference 23°C ± 5°C) ±0.6dB (-16dBm to +4dBm, -6dBm reference 23°C ± 5°C) If OPT 10 is installed, the accuracy is specified using an attenuation of 0 dB. R3765AG/67AG: 300kHz to 15MHz ±0.4dB (+2dBm to +12dBm, 7dBm reference 23°C ± 5°C) ±0.8dB (-3dBm to +17dBm, 7dBm reference 23°C ± 5°C) 15MHz to 8GHz ±0.2dB (+2dBm to +12dBm, 7dBm reference 23°C ± 5°C) ±0.4dB (-3dBm to +17dBm, 7dBm reference 23°C ± 5°C) For OPT 10 300kHz to 15MHz ±0.6dB (-3dBm to +7dBm, +2dBm reference 23°C ± 5°C) ±1.3dB (-8dBm to +12dBm, +2dBm reference 23°C ± 5°C) 15MHz to 8GHz ±0.4dB (-3dBm to +7dBm, +2dBm reference 23°C ± 5°C) ±0.6dB (-8dBm to +12dBm, +2dBm reference 23°C ± 5°C) If OPT 10 is installed, the accuracy is specified using an attenuation of 0 dB.

(Continued)

Signal purity	
Harmonic distortion	20dBc (23°C ± 5°C when maximum output)
Non harmonic spurious	30 dBc (For the maximum output, > 1 MHz offset at 23°C to ±5°C)
Phase noise (10kHz off)	85dBc/Hz (300kHz to 40MHz, 23°C ± 5°C) 85dBc/Hz-20Log (f/40MHz) (40MHz to 8GHz, 23°C ± 5°C)
Sweep function	
Sweep type	Linear, logarithmic, program or power sweep
Sweep time	0.15ms/1 point
Measurement point	3, 6, 11, 21, 51, 101, 201, 301, 401, 601, 801, 1201 point
Sweep trigger	Continuous, single, hold or external triggering
Attenuation accuracy	R3765AG/BG/CG, R3767AG/BG/CG For OPT 10, OPT 10 + OPT 11/12/13/14 Attenuation 20dB ±4dB (Attenuation=0dB reference, 23°C ± 5°C) Attenuation 40dB ±5dB (Attenuation=0dB reference, 23°C ± 5°C) Attenuation 60dB ±6dB (Attenuation=0dB reference, 23°C ± 5°C)

(3) Characteristic of the Receiver Part

Resolution bandwidth	20kHz to 10Hz (changeable at 1, 1.5, 2, 3, 4, 5 and 7 steps)
Stability	
Trace noise	0.003dBrms (300kHz to 2.6GHz, RBW 3kHz, Typical value) 0.006dBrms (2.6GHz to 3.8GHz, RBW 3kHz, Typical value) 0.012dBrms (3.8GHz to 8.0GHz, RBW 3kHz, Typical value) For OPT 12 or 13 0.014dBrms (300kHz to 2.6GHz, RBW 3kHz, Typical value) 0.022dBrms (2.6GHz to 3.8GHz, RBW 3kHz, Typical value)
Stability against temperature changes	0.01dB/°C (300kHz to 2.6GHz, Typical value) 0.02dB/°C (2.6GHz to 8.0GHz, Typical value)
Aging stability	0.005dB/week (Typical value)
Magnitude characteristic	
Magnitude resolution	0.001dB
Frequency characteristic	±1.0dB (23°C ± 5°C)
Dynamic accuracy	In reference to the value 20 dB below the allowable input level ±0.20dB (0dB to -10dB, 300kHz to 3.8GHz) ±0.40dB (0dB to -10dB, 3.8GHz to 8.0GHz) ±0.05dB (-10dB to -50dB) ±0.10dB (-50dB to -60dB) ±0.40dB (-60dB to -70dB) ±1.00dB (-70dB to -90dB) For R3765 BG with OPT 12 installed, 0 dB for an input of +9 dBm in reference to -32 dB 0.05dB (-12dB to -42dB) 0.2dB (-42dB to -52dB) 0.7dB (-52dB to -62dB) 2.0dB (-62dB to -72dB) For R3765CG with OPT 12 or 13 installed, 0 dB for an input of +4 dBm in reference to -32 dB 0.2dB (0dB to -12dB) (Typical value) 0.05dB (-12dB to -42dB) 0.2dB (-42dB to -52dB) 0.7dB (-52dB to -62dB) 2.0dB (-62dB to -72dB)

(Continued)

Phase characteristic	
Phase resolution	0.01°
Frequency characteristic	±5° (23°C ± 5°C)
Dynamic accuracy	In reference to the value 20 dB below the allowable input level ±2.0° (0dB to -10dB, 300kHz to 3.8GHz) ±4.0° (0dB to -10dB, 3.8GHz to 8.0GHz) ±0.3° (-10dB to -50dB) ±0.4° (-50dB to -60dB) ±1.5° (-60dB to -70dB) ±4.0° (-70dB to -80dB) ±8.0° (-80dB to -90dB) For R3765 BG with OPT 12 installed, 0 dB for an input of +9 dBm in reference to -32 dB 0.3° (-12dB to -42dB) 0.5° (-42dB to -52dB) 1.0° (-52dB to -62dB) 3.0° (-62dB to -72dB) For R3765CG with OPT 12 or 13 installed, 0 dB for an input of +4 dBm in reference to -32 dB 2.0° (0dB to -12dB) 0.3° (-12dB to -42dB) 0.5° (-42dB to -52dB) 1.0° (-52dB to -62dB) 3.0° (-62dB to -72dB)
Group delay characteristic	Can be obtained by the following equation. $\tau = \frac{\Delta\phi}{360 \times \Delta f}$ $\Delta\phi$: Phase difference Δf : Frequency difference (aperture frequency)
Group delay resolution	1ps
Aperture frequency	Can be set in a range from $\frac{100}{\text{Measurement point-1}} \times 2\%$ to $\frac{100}{\text{Measured point-1}} \times 50\%$.
Accuracy	$\frac{\text{phase accuracy}}{360 \times \text{Aperture frequency (Hz)}}$

(4) Test Port Characteristic

Load match	16dB (300kHz to 40MHz, 23°C ± 5°C) 18dB (40MHz to 2.6GHz, 23°C ± 5°C) 16dB (2.6GHz to 3.8GHz, 23°C ± 5°C) 14dB (3.8GHz to 8.0GHz, 23°C ± 5°C) For OPT 12 or 13 16dB (300kHz to 2GHz, 23°C ± 5°C) 15dB (2GHz to 3.8GHz, 23°C ± 5°C)
Source match	R3765BG/CG, R3767BG/CG only 14dB (300kHz to 40MHz, 23°C ± 5°C) * 16dB (40MHz to 2.6GHz, 23°C ± 5°C) * 15dB (2.6GHz to 3.8GHz, 23°C ± 5°C) * 12dB (3.8GHz to 8.0GHz, 23°C ± 5°C) * For OPT 12 or 13 14dB (300kHz to 40MHz, 23°C ± 5°C) * 16dB (40MHz to 2GHz, 23°C ± 5°C) * 15dB (2GHz to 3.8GHz, 23°C ± 5°C) * * : For OPT 10, Attenuation = 0dB
Source match (Attenuation=20/40/60dB)	R3765BG/CG+OPT 10, R3765BG/CG+OPT 10+OPT 11/14 R3767BG/CG+OPT 10, R3767BG/CG+OPT 10+OPT 11/14 13dB (300kHz to 40MHz, 23°C ±5°C) 16dB (40MHz to 2.6GHz, 23°C ±5°C) 15dB (2.6GHz to 3.8GHz, 23°C ±5°C) 12dB (3.8GHz to 8.0GHz, 23°C ±5°C) R3765BG/CG+OPT 10+OPT 12/13 13dB (300kHz to 40MHz, 23°C ±5°C) 16dB (40MHz to 2GHz, 23°C ±5°C) 15dB (2GHz to 3.8GHz, 23°C ±5°C)
Directivity	R3765BG/CG, R3767BG/CG only 28dB (300kHz to 40MHz, 23°C ± 5°C) 30dB (40MHz to 2.6GHz, 23°C ± 5°C) 26dB (2.6GHz to 3.8GHz, 23°C ± 5°C) 22dB (3.8GHz to 8.0GHz, 23°C ± 5°C) For OPT 12 or 13 28dB (300kHz to 40MHz, 23°C ± 5°C) 27dB (40MHz to 2GHz, 23°C ± 5°C) 22dB (2GHz to 3.8GHz, 23°C ± 5°C)

(Continued)

Crosstalk	90dB (300kHz to 40MHz) 100dB (40MHz to 2.6GHz) 90dB (2.6GHz to 3.8GHz) 80dB (3.8GHz to 5.0GHz) 70dB (5.0GHz to 8.0GHz) For OPT 12 or 13 80dB (300kHz to 40MHz) 85dB (40MHz to 2.0GHz) 80dB (2.0GHz to 3.8GHz) For OPT 14 90dB (300kHz to 40MHz) 95dB (40MHz to 2.6GHz) 85dB (2.6GHz to 3.8GHz) 75dB (3.8GHz to 5.0GHz) 65dB (5.0GHz to 8.0GHz)
Maximum input level	0dBm (R3765AG/67AG) +6dBm (R3765BG/67BG) +12dBm (R3765CG/67CG) (+20 dBm for OPT 12 or OPT 13)
Noise level	At the allowable input level 3kHz bandwidth -85dB (300kHz to 40MHz) -90dB (40MHz to 3.8GHz) -80dB (3.8GHz to 8.0GHz) 300Hz bandwidth -95dB (300kHz to 40MHz) -100dB (40MHz to 3.8GHz) -90dB (3.8GHz to 8.0GHz)
Maximum port-biased	R3765CG/67CG only (For the CG model only, excluding CG model analyzers with OPT 11, 13 or 14 installed) $\pm 30V_{dc}$, 0.5A
Input head damage level	+21dBm, $30V_{dc}$
Tester port connector	N type (f) (75Ω dBm for OPT 12 or OPT 13)

(5) Other Functions

Display Section	
Displaying device	8.4 inch TFT color liquid crystal display
Back light	Intensity half-value period: 40,000 hours (Typical value)
Error compensation	Normalization, Normalization & Isolation, and 1-port calibration 2 ports calibration (R3765CG/67CG only) 3 ports calibration (For OPT 11 and OPT 13 only) 4 ports calibration (OPT14 only) Averaging and smoothing Electrical length correction, Phase offset correction
Marker function	Independent 10 markers can be set to each channel. ΔMarker function, Search function, Marker → function
Limit line function	Up to 31 segments can be set. Pass/Fail display and beep sound functions
Save/Call function	Register format: Up to 20 registers are used to save data. File format: Saved to a floppy disk or the internal memory (8 MB).
Controller function	BASIC programming function (Program size: 2MB)
FDD function	Compliant with MS-DOS FAT format in three modes (DD 720 KB, HD 1.2 MB or 1.4 MB)

(6) Connection to External Devices

Signal for external display	15 pins, D-SUB connector (VGA)
GPIB	IEEE488.1, IEEE488.2 applicable
Parallel port	TLL level Output port (8 bits × 2 ports) Input/Output port (4 bits × 2 ports)
Serial port	Serial I/O port for the accessories
Printer port	Compliant with IEEE-1284-1994
LAN port (Option)	10Base-T
Keyboard	Based on IBM PC-AT
External reference frequency input	1MHz, 2MHz, 5MHz, 10MHz (±10ppm) More than 0dBm (50Ω)
Probe power	±12V ±0.5V, 300mA

(7) General Specification

Operating environment	
When FDD used.	Temperature range +5 to +40°C Relative humidity under 80% (non-condensing)
When FDD unused.	Temperature range 0 to +50°C Relative humidity under 80% (non-condensing)
Storing environment	-20 to +60°C
Power source	AC100V to 120V, 50Hz/60Hz AC220V to 240V, 50Hz/60Hz (Auto-switch between 100VAC and 200VAC type)
Outer dimensions	About 424mm (width) × 220mm (height) × 400mm (depth)
Mass	18.5kg or less
Power draw	250VA or less

APPENDIX

Information for reference useful in operating is described in the APPENDIX.

A.1 The Relation of Data between each Function

Describes about the relation of data between each function.

A.1.1 The Relation of Data between each Channel and each Function

Describes about the relation between the data of each function and each channel.

The sub-channel of channel 1 is channel 3, and the sub-channel of channel 2 is channel 4.

(1) In the case of COUPLE CH ON

Function	Channel			
	CH1	CH3	CH2	CH4
MEAS	○	×	○	×
SUB MEAS	×	○	×	○
STIMULUS/RBW	Common			
Averaging	Common		Common	
Smoothing	Common		Common	
Trace operation	Independent	Independent	Independent	Independent
Parameter conversion	Independent	Independent	Independent	Independent
FORMAT	Independent	Independent	Independent	Independent
Scale	Independent	Independent	Independent	Independent
Marker	Independent	Independent	Independent	Independent
Limit line	Independent	Independent	Independent	Independent

Mark ○ shows that it can be set.
Mark × shows that it cannot be set.

(2) In the case of COUPLE CH OFF

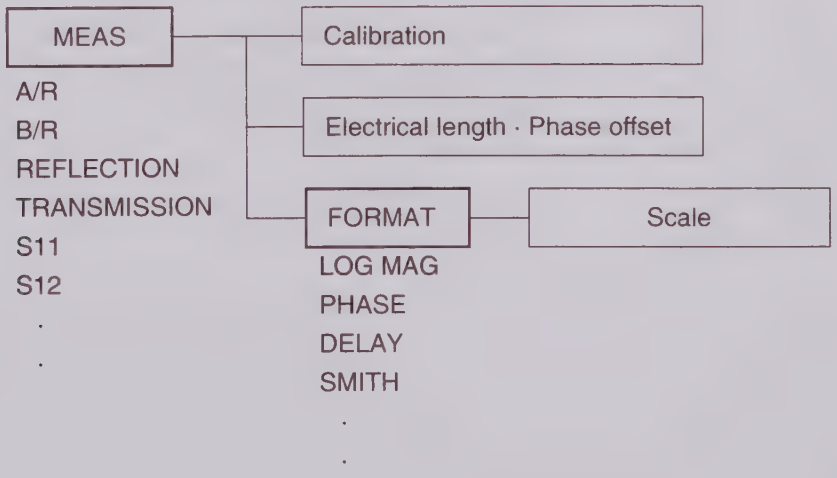
Function	Channel			
	CH1	CH3	CH2	CH4
MEAS	○	×	○	×
SUB MEAS	×	○	×	○
STIMULUS/RBW	Common		Common	
Averaging	Common		Common	
Smoothing	Common		Common	
Trace operation	Independent	Independent	Independent	Independent
Parameter conversion	Independent	Independent	Independent	Independent
FORMAT	Independent	Independent	Independent	Independent
Scale	Independent	Independent	Independent	Independent
Marker	Independent	Independent	Independent	Independent
Limit line	Independent	Independent	Independent	Independent

Mark ○ shows that it can be set.
Mark × shows that it cannot be set.

A.1.2 The Data Interlocking to each Item in MEAS Menu.

The data of the following functions are interlocked for each selected input port in the R3765/67G series.

Also the data of the scale function are interlocked for each FORMAT as well.



A.2 Measuring Time

The measurement time is the time to acquire the data plus the frequency setup time.
Data acquiring time is set up as SWEEP TIME.
Frequency setup time is different depending on the frequency setup.
The following shows the typical values.

(Example)

Start frequency	1GHz
Stop frequency	2GHz
Measuring point number	101 points

① Frequency between measuring points: 10MHz → Setup time, 50μsec/point

Total setup time is (50μsec/point) × 100 points = 5msec.

- When the frequency between the measuring points is more than 5MHz, the setup time is 50μsec per about 5MHz.

② Band switching time: About 5msec

- The R3765/67G series is composed by the following frequency bands. Each time the band is switched, the setup time is about 5msec.

Band	Frequency range
1	300kHz to 3MHz
2	3MHz to 15MHz
3	15MHz to 20MHz
4	20MHz to 40MHz
5	40MHz to 80MHz
6	80MHz to 160MHz
7	160MHz to 320MHz
8	320MHz to 560MHz
9	560MHz to 1120MHz
10	1120MHz to 2160MHz
11	2160MHz to 3800MHz
12	3800MHz to 6000MHz
13	6000MHz to 8000MHz

③ The setup time is the total of ① and ②, that is 18msec. Therefore, the measurement time is SWEEP TIME plus 18msec.

A.3 Initial Setting

Function	Initialize method	
	Power on or preset	*RST
Stimulus		
Sweep type	Linear frequency sweep	Linear frequency sweep
Continuous sweep	ON	OFF
Trigger source	Internal (FREE RUN)	Internal (FREE RUN)
Trigger delay	OFF (0sec)	OFF (0sec)
Sweep time	65.325msec(AUTO)	390.325msec(AUTO)
Measurement point	201	1201
Start frequency	300kHz	300kHz
Stop frequency	3.8GHz (R3765AG/BG/CG) 8.0GHz (R3767AG/BG/CG)	3.8GHz (R3765AG/BG/CG) 8.0GHz (R3767AG/BG/CG)
Frequency display	Start/Stop	Start/Stop
Fixed frequency of level sweep	1GHz	1GHz
Output level	* 1	* 1
Start level	* 2	* 2
Stop level	* 2	* 2
Two-channel interlocking	ON	ON
Program sweep segment	All clear	All clear
Response		
Dual channel	OFF	OFF
Active channel	CH1	CH1
Resolution bandwidth	10kHz	10kHz
Selection item of input port	* 3	* 3
Average	OFF (Number of times 16)	OFF (Number of times 16)
Trace operation	NONE	NONE
Conversion	NONE	NONE
Characteristic impedance	50Ω	50Ω
Measurement format	* 4	* 4
Group delay aperture	1.00%	0.01%
Smoothing	OFF (Aperture 1.00%)	OFF (Aperture 0.01%)
Display	Data	Data
Split/Overlap	Overlap	Overlap
Label	NONE	NONE
Reference value		
Logarithmic magnitude	0dB	0dB
Phase	0°	0°
Group delay	0sec	0sec
Smith chart	1	1
Polar coordinate	1	1
Linear amplitude	0	0
SWR	1	1
Real part	0	0
Imaginary part	0	0
Continuous phase	0°	0°

Function	Initialize method	
	Power on or preset	*RST
The valaue per division of Y-axis		
Logarithmic magnitude	* 5	* 5
Phase	45°	45°
Group delay	100nsec	100nsec
Smith chart	–	–
Polar coordinate	–	–
Linear amplitude	100m	100m
SWR	1	1
Real part	1	1
Imaginary part	1	1
Continuous phase	360°	360°
Reference position		
Logarithmic magnitude	* 6	* 6
Phase	50%	50%
Group delay	50%	50%
Smith chart	–	–
Polar coordinate	–	–
Linear amplitude	0%	0%
SWR	0%	0%
Real part	50%	50%
Imaginary part	50%	50%
Continuous phase	50%	50%
Calibration		
Correct measurement	OFF	OFF
Calibration data	Clear	Clear
Electrical length correction	OFF (0sec)	OFF (0sec)
Phase offset	OFF (0°)	OFF (0°)
Measurement end extension correction	OFF	OFF
R input	0 sec	0 sec
A input	0 sec	0 sec
B input	0 sec	0 sec
Port 1	0 sec	0 sec
Port 2	0 sec	0 sec
Port 3 (OPT11)	0 sec	0 sec
Velocity factor	1	1
Time domain (OPT70)		
Time domain	OFF	OFF
Start time	0sec	0sec
Stop time	-	-
Conversion Mode	BAND PASS	BAND PASS
Window	NORMAL	NORMAL
Gate (OPT70)		
Gate function	OFF	OFF
Gate start time	0sec	0sec
Gate stop time	10nsec	10nsec
Gate shape	NORMAL	NORMAL

Function	Initialize method	
	Power on or preset	*RST
CDMA IF filter analysis		
CDMA IF filter gate function	OFF	OFF
CDMA IF filter gate start time	0sec	0sec
CDMA IF filter gate stop time	6µsec	6µsec
CDMA IF filter gate shape	CDMA IF	CDMA IF
CDMA IF filter magnitude analysis	OFF	OFF
Search attenuation	6dB	6dB
Guaranteed attenuation measurement First frequency	900kHz	900kHz
Second frequency	1.2MHz	1.2MHz
Phase linearity analysis	OFF	OFF

* 1 : Output level

Type	Power on or preset	*RST
AG	0dBm	0dBm
BG	0dBm	0dBm
CG, CG+OPT11	10dBm	10dBm
CG+OPT10, CG+OPT10+OPT11	5dBm	5dBm
CG+OPT12/13	4dBm	4dBm
CG+OPT10+OPT12/13	-1dBm	-1dBm
CG+OPT10+OPT14	3dBm	3dBm
CG+OPT14	8dBm	8dBm

* 2 : Start/Stop level

Type	Power on or preset		*RST	
	Start	Stop	Start	Stop
AG	-3dBm	0dBm	-3dBm	17dBm
AG+OPT10	-8dBm	0dBm	-8dBm	12dBm
BG	-13dBm	0dBm	-13dBm	7dBm
BG+OPT10	-18dBm	0dBm	-18dBm	2dBm
BG+12	-11dBm	0dBm	-11dBm	9dBm
BG+OPT10+OPT12	-16dBm	0dBm	-16dBm	4dBm
CG, CG+OPT11/14	-10dBm	0dBm	-10dBm	10dBm
CG+OPT12/13	-16dBm	0dBm	-16dBm	4dBm
CG+OPT10, CG+OPT10+OPT11/14	-15dBm	0dBm	-15dBm	5dBm
CG+OPT10+OPT12/13	-21dBm	-1dBm	-21dBm	-1dBm

* 3: Selection item of input port

Type \ Channel	CH1	CH2	CH3	CH4
AG	A/R	B/R	A/R	B/R
BG	REFLECTION	TRANSMISSION	REFLECTION	TRANSMISSION
CG	S11	S21	S11	S21

* 4: Measurement format

Type \ Channel	CH1	CH2	CH3	CH4
AG	LOG MAG	LOG MAG	LOG MAG	LOG MAG
BG	LOG MAG	LOG MAG	POLAR	LOG MAG
CG	LOG MAG	LOG MAG	POLAR	LOG MAG

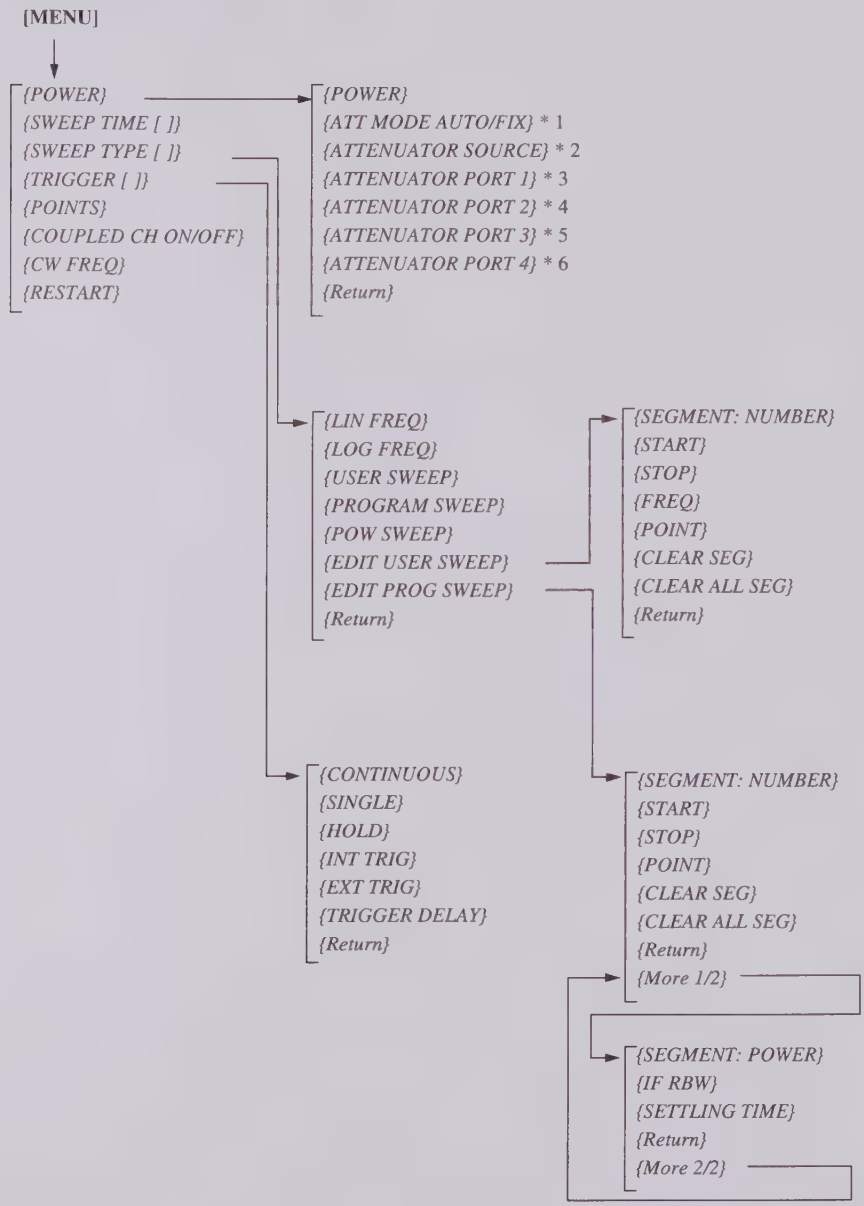
* 5: Logarithmic magnitude (the value per division of Y-axis)

Type \ Channel	CH1	CH2	CH3	CH4
AG	10dB	10dB	10dB	10dB
BG	10dB	10dB	1 UNIT	10dB
CG	10dB	10dB	1 UNIT	10dB

* 6: Logarithmic magnitude (reference position)

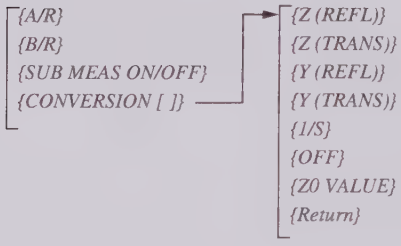
Type \ Channel	CH1	CH2	CH3	CH4
AG	90%	90%	90%	90%
BG	90%	90%	-	90%
CG	90%	90%	-	90%

A.4 Soft Key Menu List

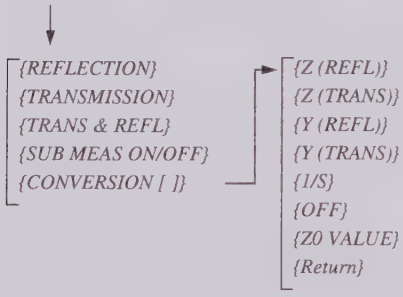


* 1: When OPT10 (Output attenuator) installed
* 2: AG type when OPT10 (Output attenuator) installed
* 3: BG/CG type when OPT10 (Output attenuator) installed
* 4: CG type when OPT10 (Output attenuator) installed
* 5: When OPT10 (Output attenuator) and OPT11 (Built-in 3-port Test Set)/OPT13 (Impedance: 75Ω, Built-in 3-port Test Set)/OPT14 (Built-in 4-port Test Set) installed
* 6: When OPT10 (Output attenuator) and OPT14 (Built-in 4-port Test Set) installed

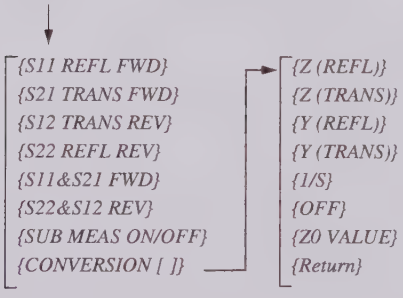
[MEAS] **For the R3765AG/67AG**

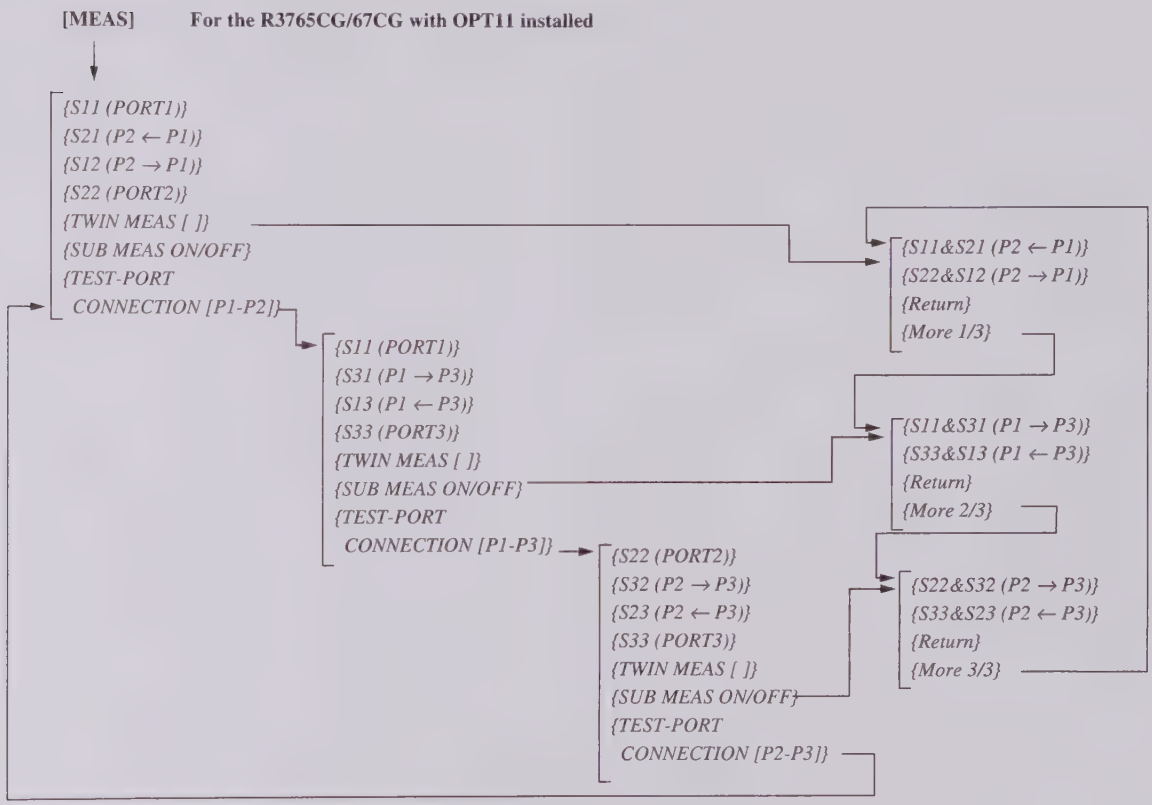


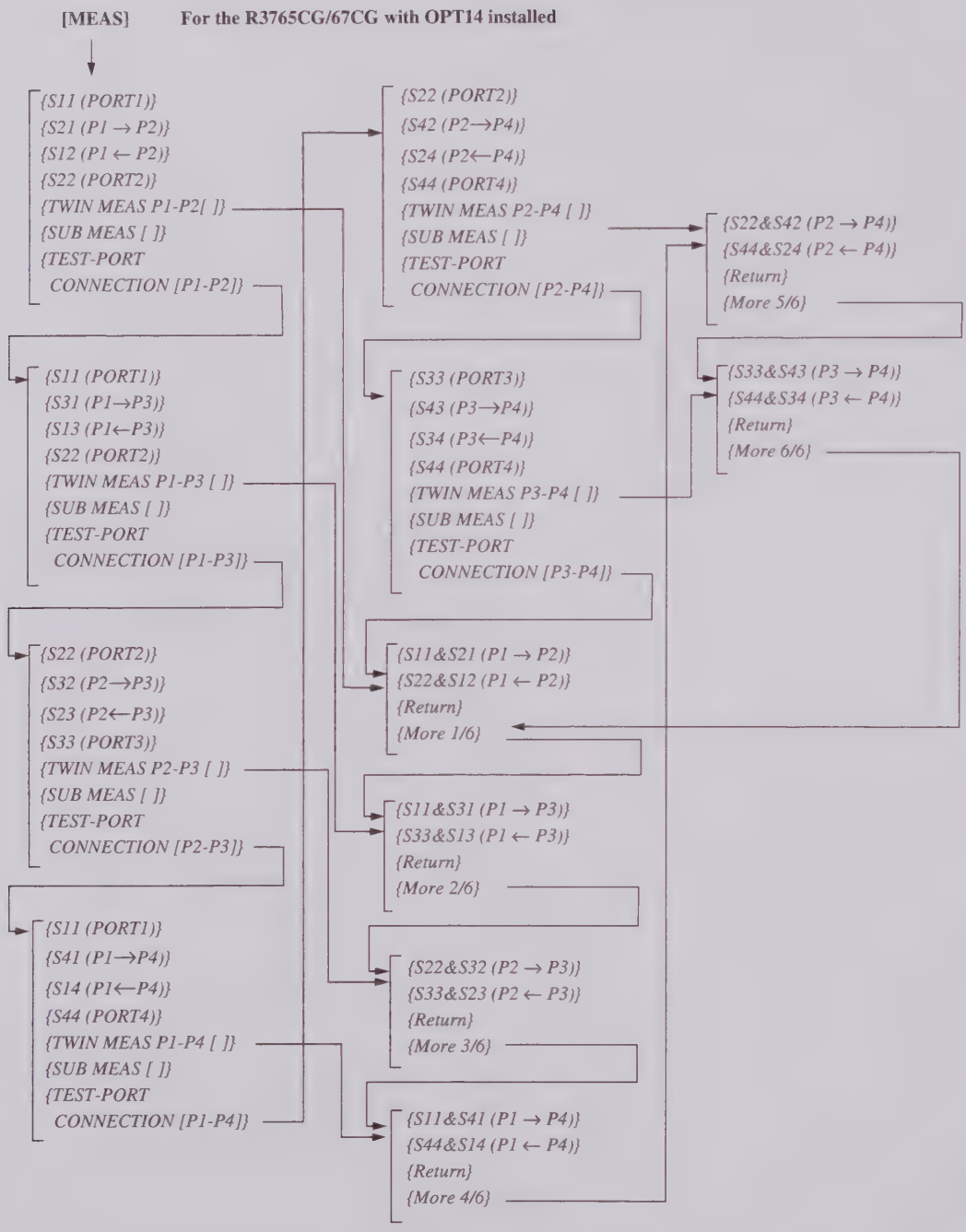
[MEAS] **For the R3765BG/67BG**

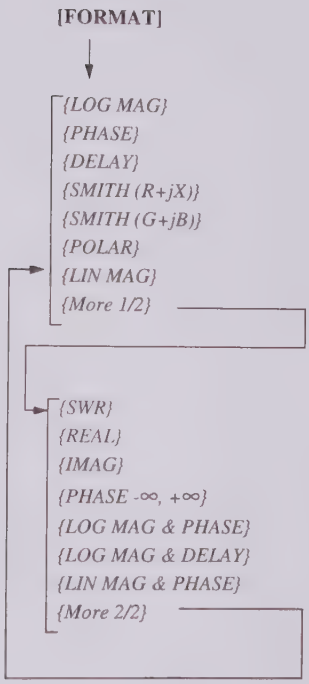


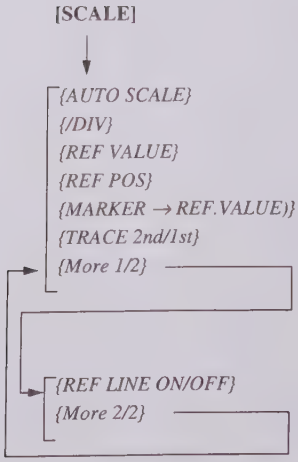
[MEAS] **For the R3765CG/67CG**

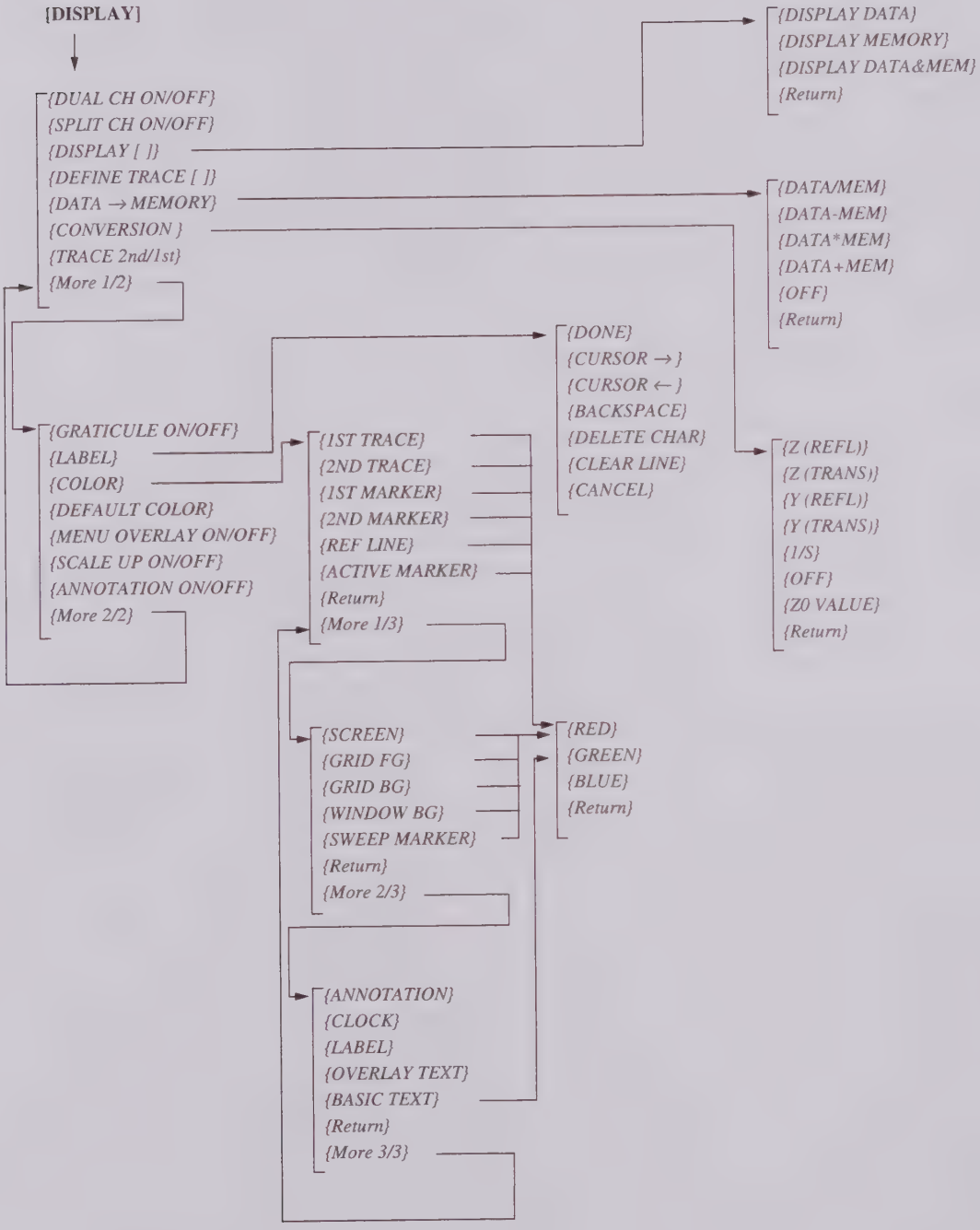


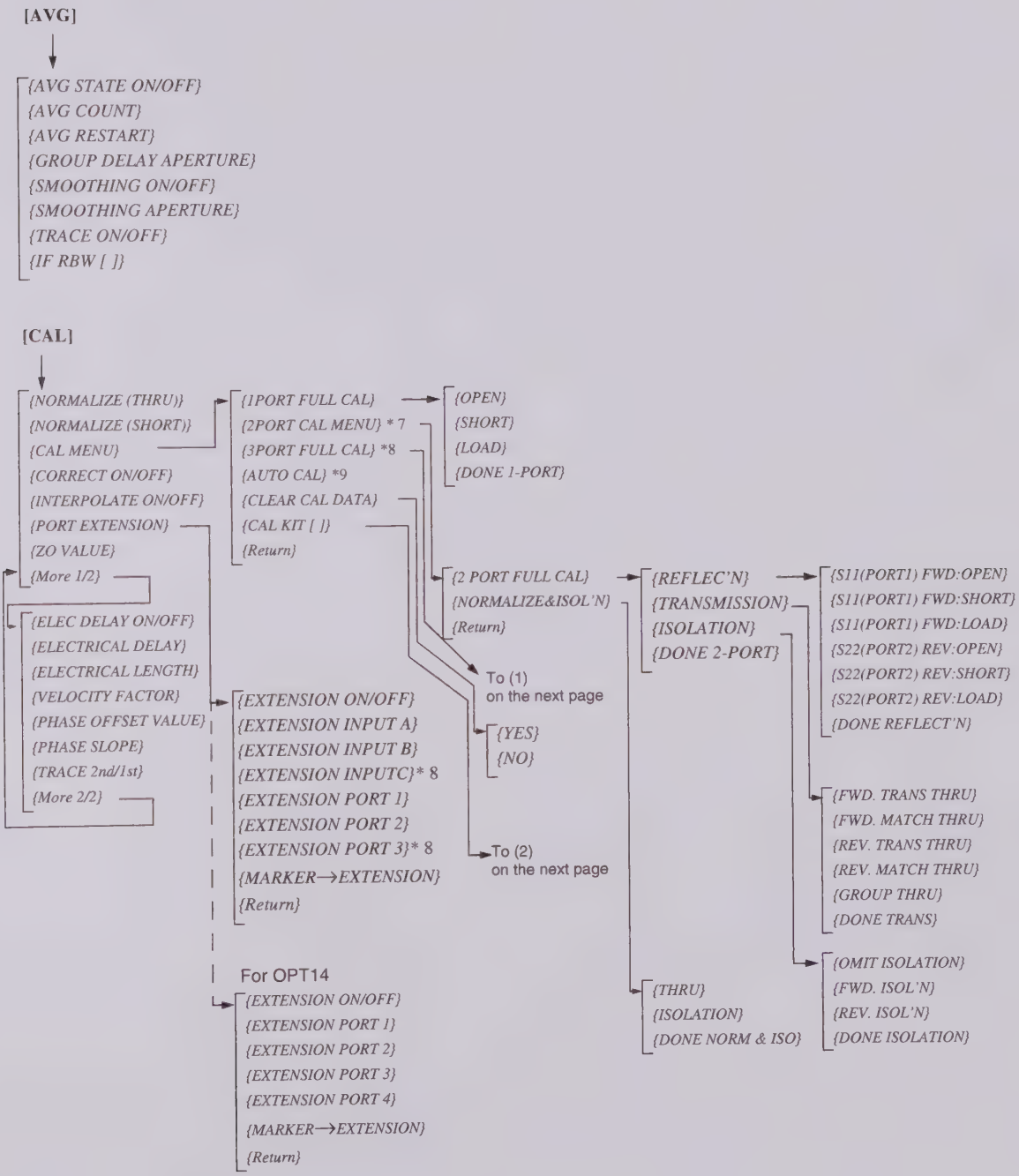

[MEAS]
For the R3765CG/67CG with OPT11 installed
{S11 (PORT1)}
{S21 (P2 ← P1)}
{S12 (P2 → P1)}
{S22 (PORT2)}
{TWIN MEAS [ ]}
{SUB MEAS ON/OFF}
{TEST-PORT CONNECTION [P1-P2]}
{S11&S21 (P2 ← P1)}
{S22&S12 (P2 → P1)}
{Return}
{More 1/3}
{S11 (PORT1)}
{S31 (P1 → P3)}
{S13 (P1 ← P3)}
{S33 (PORT3)}
{TWIN MEAS [ ]}
{SUB MEAS ON/OFF}
{TEST-PORT CONNECTION [P1-P3]}
{S11&S31 (P1 → P3)}
{S33&S13 (P1 ← P3)}
{Return}
{More 2/3}
{S22 (PORT2)}
{S32 (P2 → P3)}
{S23 (P2 ← P3)}
{S33 (PORT3)}
{TWIN MEAS [ ]}
{SUB MEAS ON/OFF}
{TEST-PORT CONNECTION [P2-P3]}
{S22&S32 (P2 → P3)}
{S33&S23 (P2 ← P3)}
{Return}
{More 3/3}


[MEAS]
For the R3765CG/67CG with OPT14 installed
{S11 (PORT1)}
{S21 (P1 → P2)}
{S12 (P1 ← P2)}
{S22 (PORT2)}
{TWIN MEAS P1-P2[ ]}
{SUB MEAS [ ]}
{TEST-PORT CONNECTION [P1-P2]}
{S22 (PORT2)}
{S42 (P2→P4)}
{S24 (P2←P4)}
{S44 (PORT4)}
{TWIN MEAS P2-P4 [ ]}
{SUB MEAS [ ]}
{TEST-PORT CONNECTION [P2-P4]}
{S22&S42 (P2 → P4)}
{S44&S24 (P2 ← P4)}
{Return}
{More 5/6}
{S11 (PORT1)}
{S31 (P1→P3)}
{S13 (P1←P3)}
{S22 (PORT2)}
{TWIN MEAS P1-P3 [ ]}
{SUB MEAS [ ]}
{TEST-PORT CONNECTION [P1-P3]}
{S33 (PORT3)}
{S43 (P3→P4)}
{S34 (P3←P4)}
{S44 (PORT4)}
{TWIN MEAS P3-P4 [ ]}
{SUB MEAS [ ]}
{TEST-PORT CONNECTION [P3-P4]}
{S33&S43 (P3 → P4)}
{S44&S34 (P3 ← P4)}
{Return}
{More 6/6}
{S22 (PORT2)}
{S32 (P2→P3)}
{S23 (P2←P3)}
{S33 (PORT3)}
{TWIN MEAS P2-P3 [ ]}
{SUB MEAS [ ]}
{TEST-PORT CONNECTION [P2-P3]}
{S11&S21 (P1 → P2)}
{S22&S12 (P1 ← P2)}
{Return}
{More 1/6}
{S11 (PORT1)}
{S41 (P1→P4)}
{S14 (P1←P4)}
{S44 (PORT4)}
{TWIN MEAS P1-P4 [ ]}
{SUB MEAS [ ]}
{TEST-PORT CONNECTION [P1-P4]}
{S11&S31 (P1 → P3)}
{S33&S13 (P1 ← P3)}
{Return}
{More 2/6}
{S22&S32 (P2 → P3)}
{S33&S23 (P2 ← P3)}
{Return}
{More 3/6}
{S11&S41 (P1 → P4)}
{S44&S14 (P1 ← P4)}
{Return}
{More 4/6}

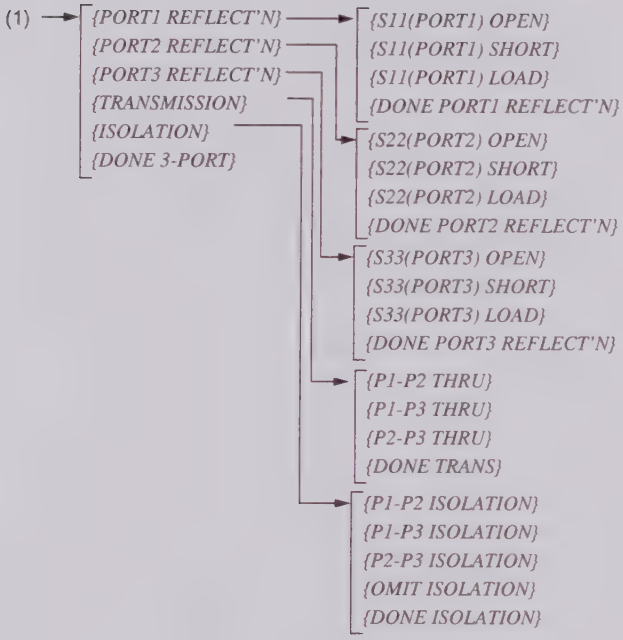

[FORMAT]
{LOG MAG}
{PHASE}
{DELAY}
{SMITH (R+jX)}
{SMITH (G+jB)}
{POLAR}
{LIN MAG}
{More 1/2}
{SWR}
{REAL}
{IMAG}
{PHASE -∞, +∞}
{LOG MAG & PHASE}
{LOG MAG & DELAY}
{LIN MAG & PHASE}
{More 2/2}

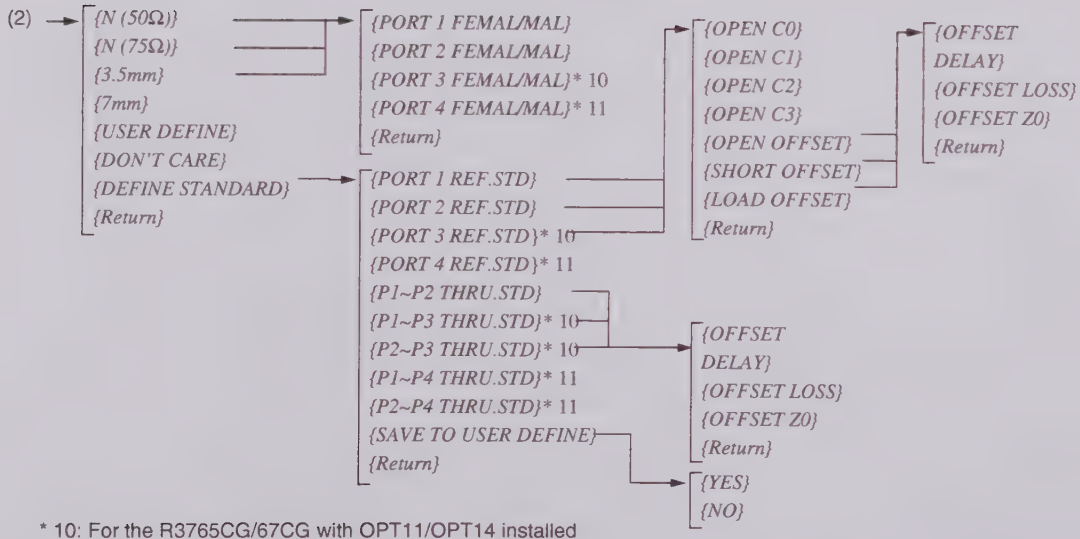

[SCALE]
{AUTO SCALE}
{/DIV}
{REF VALUE}
{REF POS}
{MARKER → REF.VALUE)}
{TRACE 2nd/1st}
{More 1/2}
{REF LINE ON/OFF}
{More 2/2}


[DISPLAY]
{DUAL CH ON/OFF}
{SPLIT CH ON/OFF}
{DISPLAY [ ]}
{DEFINE TRACE [ ]}
{DATA → MEMORY}
{CONVERSION }
{TRACE 2nd/1st}
{More 1/2}
{DISPLAY DATA}
{DISPLAY MEMORY}
{DISPLAY DATA&MEM}
{Return}
{DATA/MEM}
{DATA-MEM}
{DATA*MEM}
{DATA+MEM}
{OFF}
{Return}
{GRATICULE ON/OFF}
{LABEL}
{COLOR}
{DEFAULT COLOR}
{MENU OVERLAY ON/OFF}
{SCALE UP ON/OFF}
{ANNOTATION ON/OFF}
{More 2/2}
{1ST TRACE}
{2ND TRACE}
{1ST MARKER}
{2ND MARKER}
{REF LINE}
{ACTIVE MARKER}
{Return}
{More 1/3}
{DONE}
{CURSOR →}
{CURSOR ←}
{BACKSPACE}
{DELETE CHAR}
{CLEAR LINE}
{CANCEL}
{Z (REFL)}
{Z (TRANS)}
{Y (REFL)}
{Y (TRANS)}
{1/S}
{OFF}
{Z0 VALUE}
{Return}
{SCREEN}
{GRID FG}
{GRID BG}
{WINDOW BG}
{SWEEP MARKER}
{Return}
{More 2/3}
{RED}
{GREEN}
{BLUE}
{Return}
{ANNOTATION}
{CLOCK}
{LABEL}
{OVERLAY TEXT}
{BASIC TEXT}
{Return}
{More 3/3}

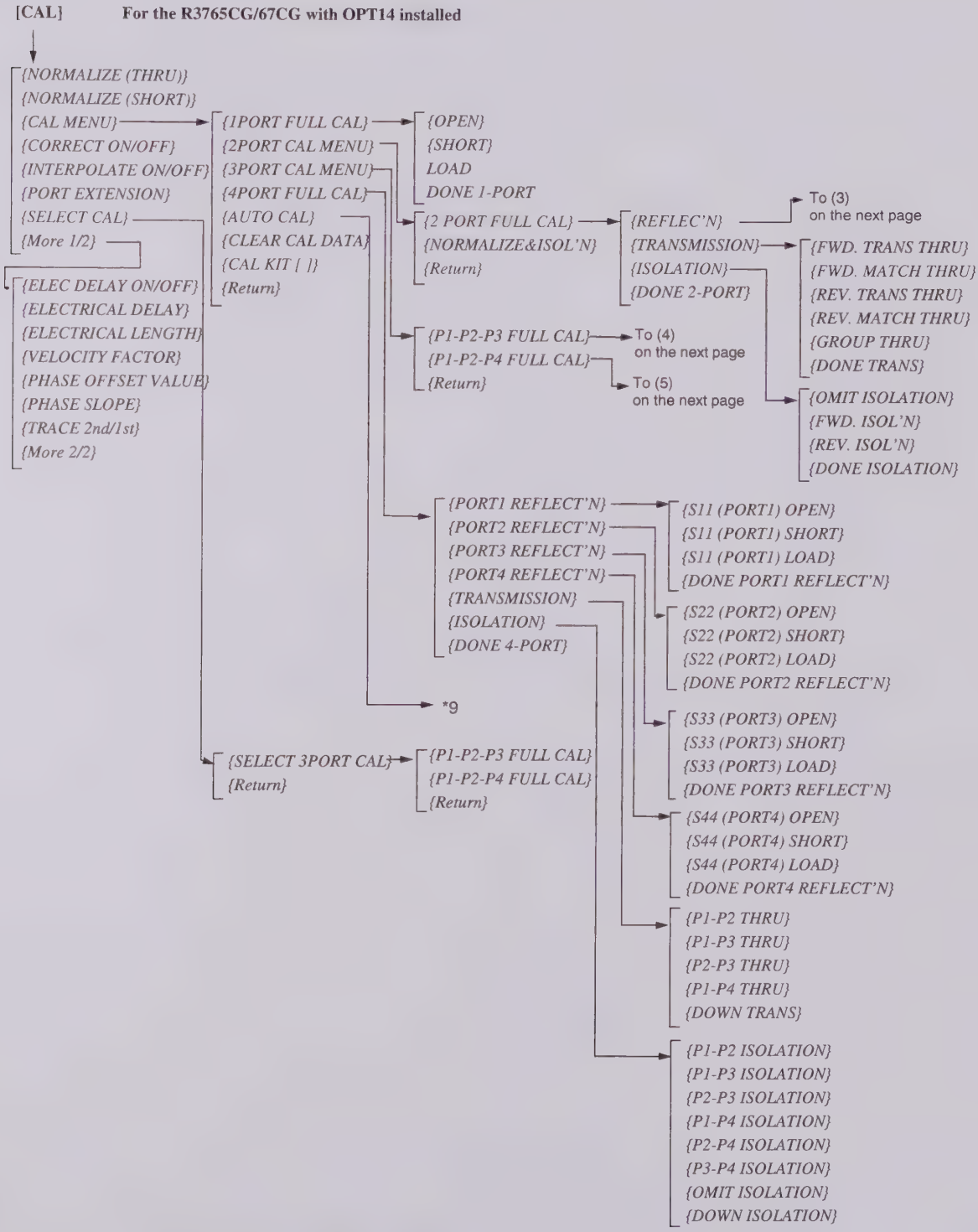


* 7: For the R3765CG/67CG
* 8: For the R3765CG/67CG with OPT11 installed
* 9: Refer to R17050 Automatic Calibration Kit Manual.

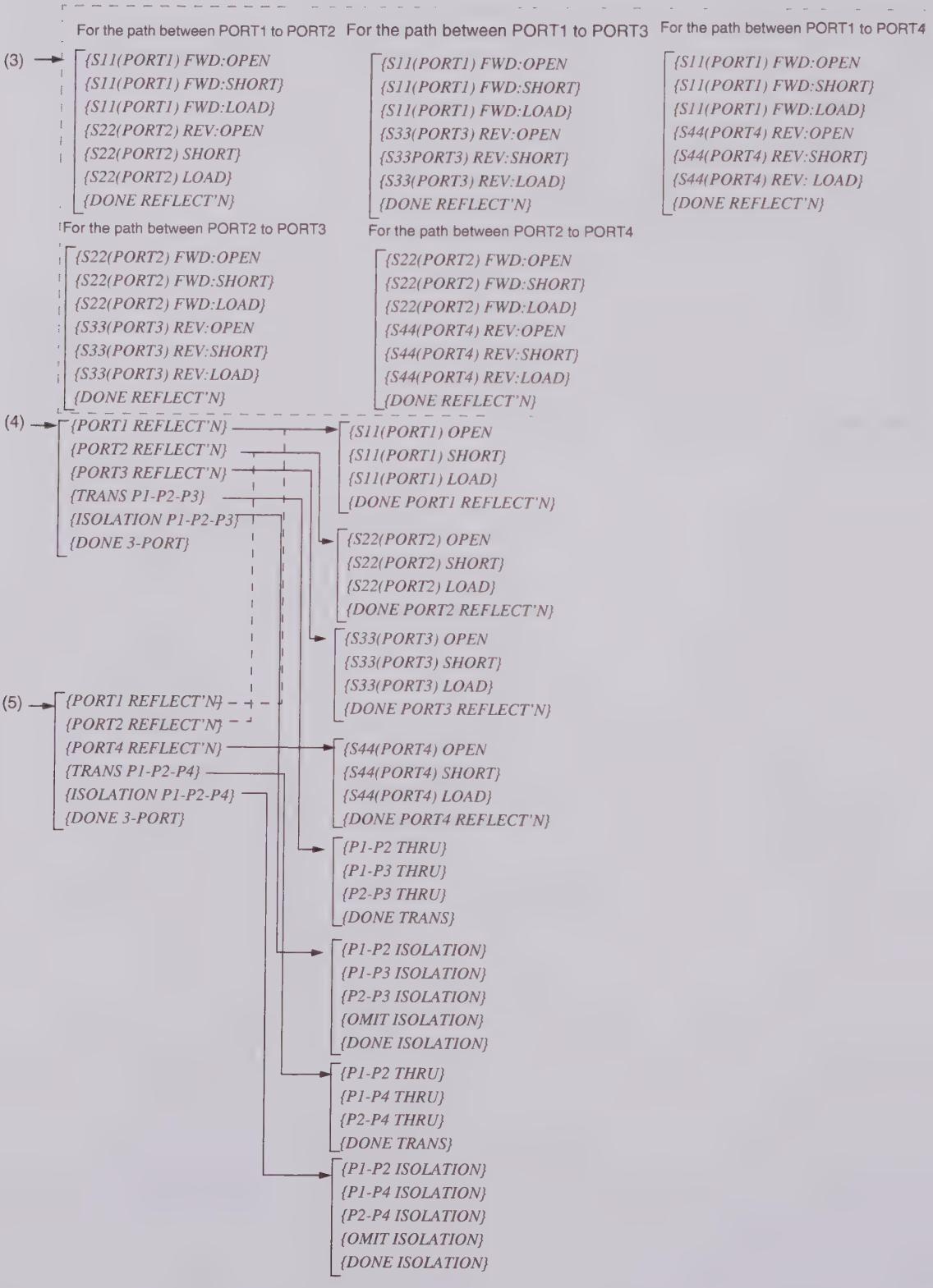


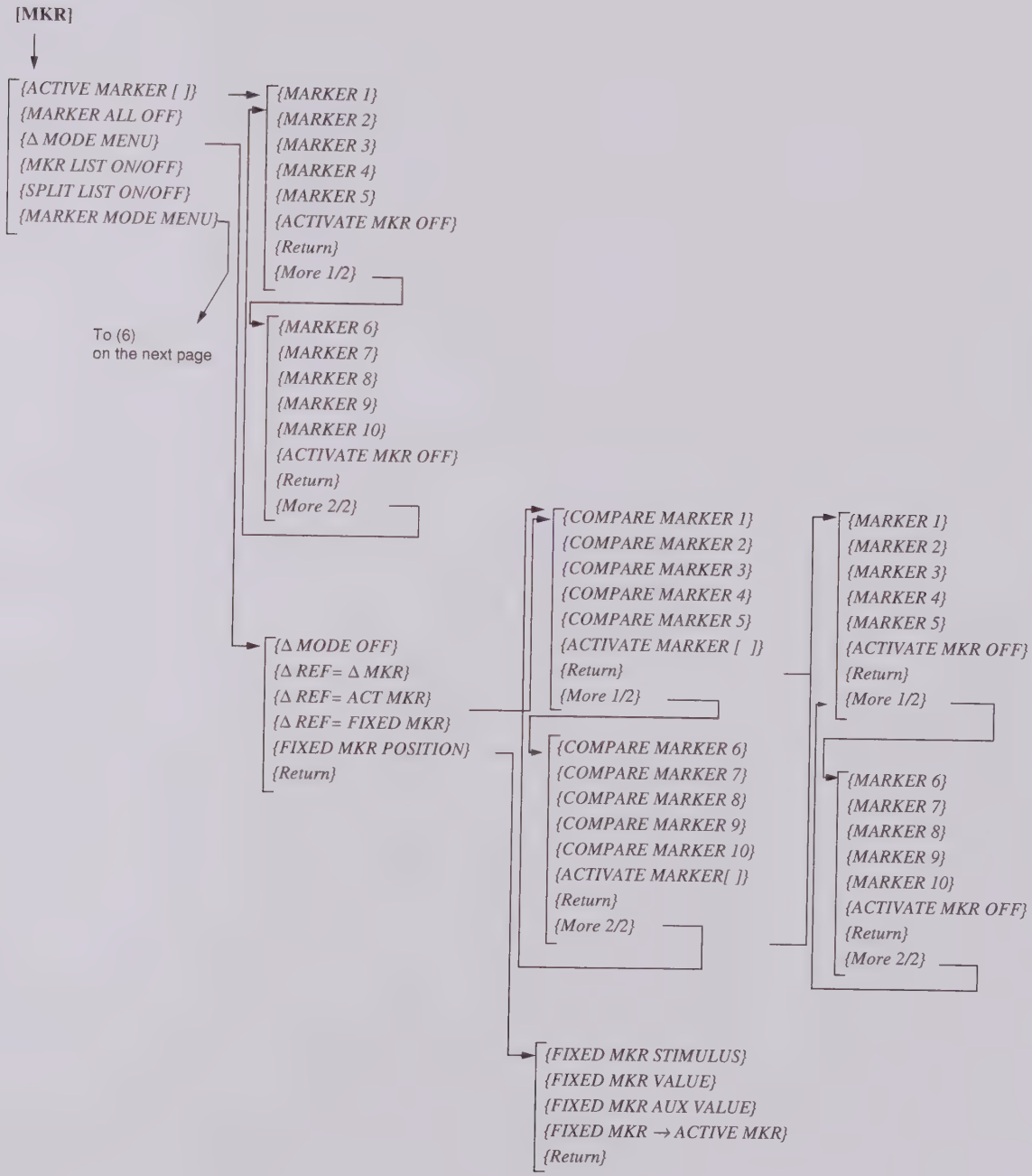


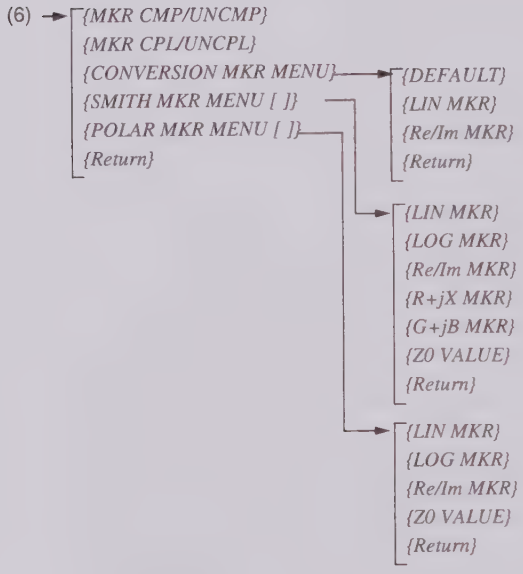
* 10: For the R3765CG/67CG with OPT11/OPT14 installed
* 11: For the R3765CG/67CG with OPT14 installed

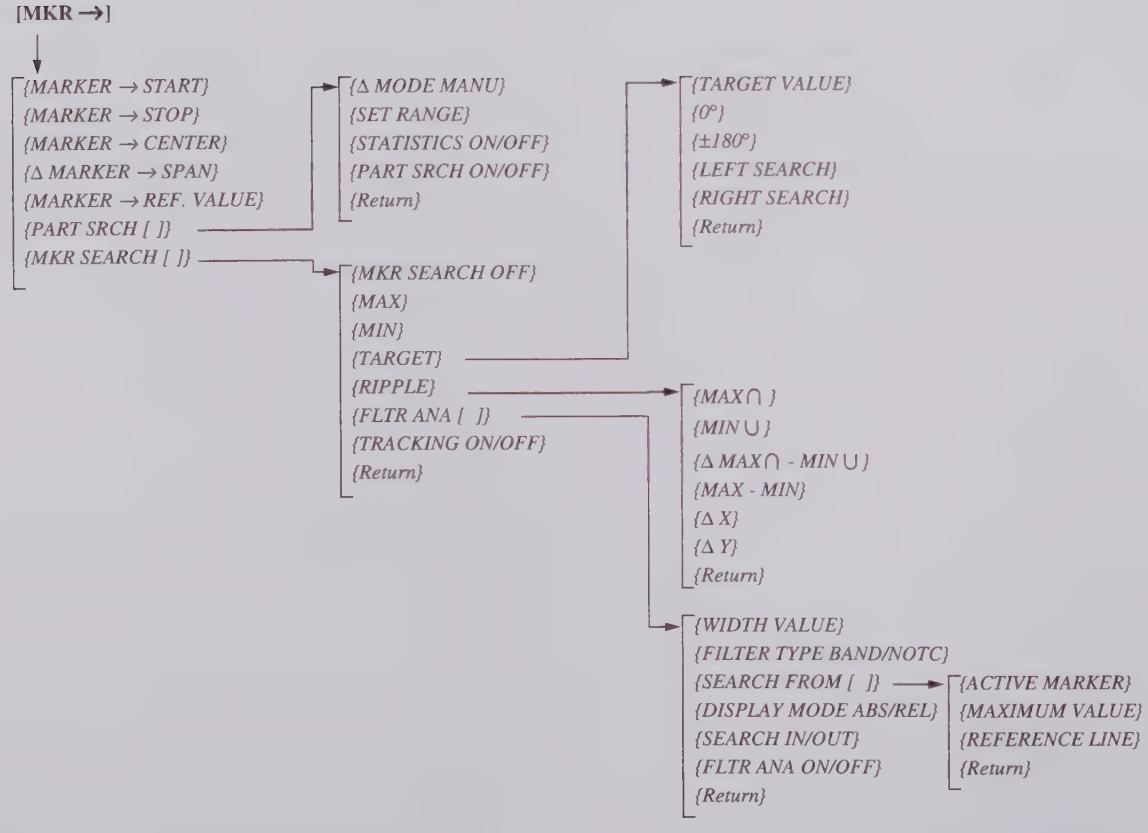


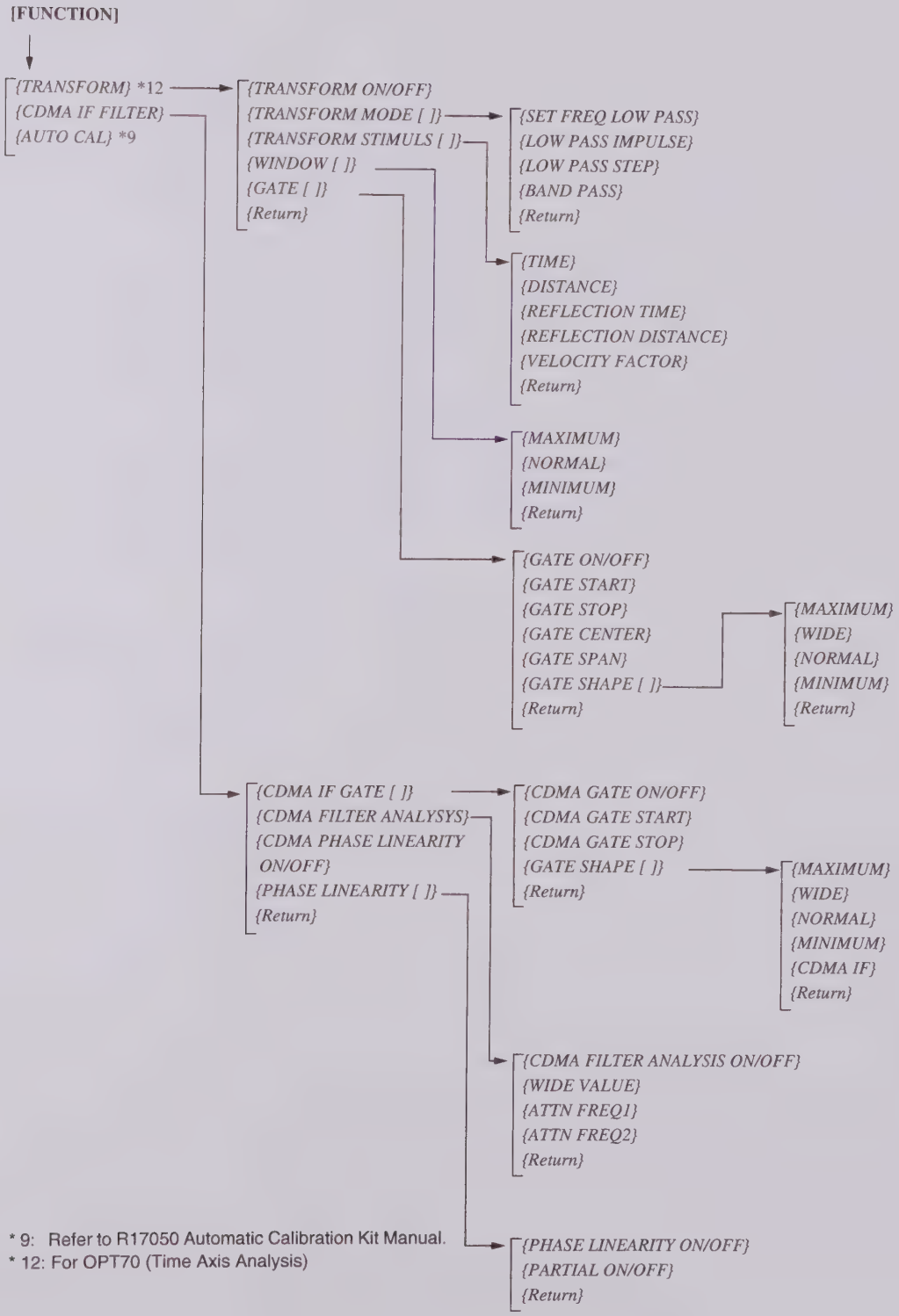
* 9 : Refer to R17050 Automatic Calibration Kit Manual.


For the path between PORT1 to PORT2
For the path between PORT1 to PORT3
For the path between PORT1 to PORT4
(3)
{S11(PORT1) FWD:OPEN}
{S11(PORT1) FWD:SHORT}
{S11(PORT1) FWD:LOAD}
{S22(PORT2) REV:OPEN}
{S22(PORT2) SHORT}
{S22(PORT2) LOAD}
{DONE REFLECT'N}
{S11(PORT1) FWD:OPEN}
{S11(PORT1) FWD:SHORT}
{S11(PORT1) FWD:LOAD}
{S33(PORT3) REV:OPEN}
{S33PORT3) REV:SHORT}
{S33(PORT3) REV:LOAD}
{DONE REFLECT'N}
{S11(PORT1) FWD:OPEN}
{S11(PORT1) FWD:SHORT}
{S11(PORT1) FWD:LOAD}
{S44(PORT4) REV:OPEN}
{S44(PORT4) REV:SHORT}
{S44(PORT4) REV: LOAD}
{DONE REFLECT'N}
For the path between PORT2 to PORT3
For the path between PORT2 to PORT4
{S22(PORT2) FWD:OPEN}
{S22(PORT2) FWD:SHORT}
{S22(PORT2) FWD:LOAD}
{S33(PORT3) REV:OPEN}
{S33(PORT3) REV:SHORT}
{S33(PORT3) REV:LOAD}
{DONE REFLECT'N}
{S22(PORT2) FWD:OPEN}
{S22(PORT2) FWD:SHORT}
{S22(PORT2) FWD:LOAD}
{S44(PORT4) REV:OPEN}
{S44(PORT4) REV:SHORT}
{S44(PORT4) REV:LOAD}
{DONE REFLECT'N}
(4)
{PORT1 REFLECT'N}
{PORT2 REFLECT'N}
{PORT3 REFLECT'N}
{TRANS P1-P2-P3}
{ISOLATION P1-P2-P3}
{DONE 3-PORT}
{S11(PORT1) OPEN}
{S11(PORT1) SHORT}
{S11(PORT1) LOAD}
{DONE PORT1 REFLECT'N}
{S22(PORT2) OPEN}
{S22(PORT2) SHORT}
{S22(PORT2) LOAD}
{DONE PORT2 REFLECT'N}
{S33(PORT3) OPEN}
{S33(PORT3) SHORT}
{S33(PORT3) LOAD}
{DONE PORT3 REFLECT'N}
(5)
{PORT1 REFLECT'N}
{PORT2 REFLECT'N}
{PORT4 REFLECT'N}
{TRANS P1-P2-P4}
{ISOLATION P1-P2-P4}
{DONE 3-PORT}
{S44(PORT4) OPEN}
{S44(PORT4) SHORT}
{S44(PORT4) LOAD}
{DONE PORT4 REFLECT'N}
{P1-P2 THRU}
{P1-P3 THRU}
{P2-P3 THRU}
{DONE TRANS}
{P1-P2 ISOLATION}
{P1-P3 ISOLATION}
{P2-P3 ISOLATION}
{OMIT ISOLATION}
{DONE ISOLATION}
{P1-P2 THRU}
{P1-P4 THRU}
{P2-P4 THRU}
{DONE TRANS}
{P1-P2 ISOLATION}
{P1-P4 ISOLATION}
{P2-P4 ISOLATION}
{OMIT ISOLATION}
{DONE ISOLATION}

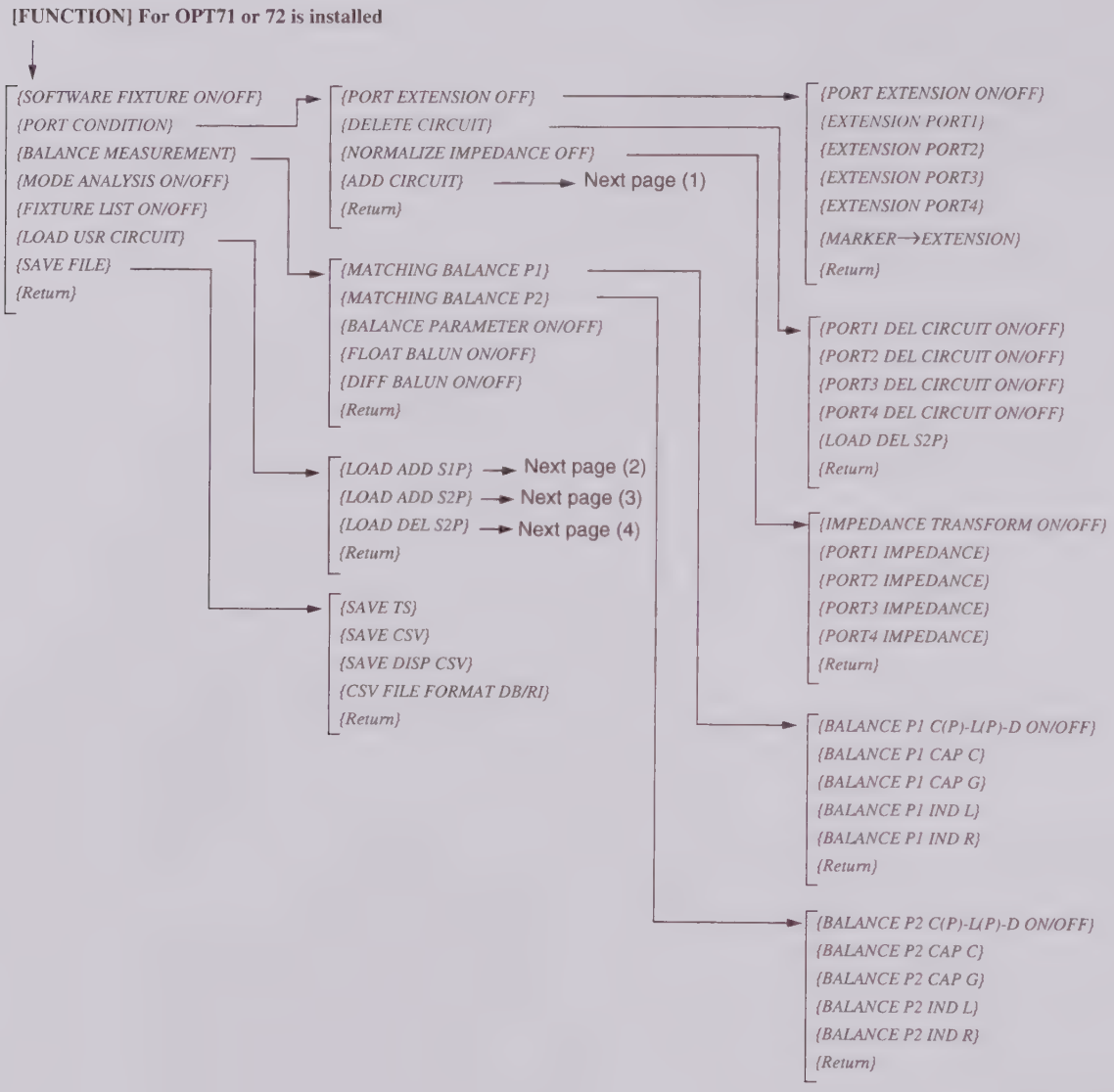

[MKR]
{ACTIVE MARKER [ ]}
{MARKER ALL OFF}
{Δ MODE MENU}
{MKR LIST ON/OFF}
{SPLIT LIST ON/OFF}
{MARKER MODE MENU}
To (6)
on the next page
{MARKER 1}
{MARKER 2}
{MARKER 3}
{MARKER 4}
{MARKER 5}
{ACTIVATE MKR OFF}
{Return}
{More 1/2}
{MARKER 6}
{MARKER 7}
{MARKER 8}
{MARKER 9}
{MARKER 10}
{ACTIVATE MKR OFF}
{Return}
{More 2/2}
{Δ MODE OFF}
{Δ REF= Δ MKR}
{Δ REF= ACT MKR}
{Δ REF= FIXED MKR}
{FIXED MKR POSITION}
{Return}
{COMPARE MARKER 1}
{COMPARE MARKER 2}
{COMPARE MARKER 3}
{COMPARE MARKER 4}
{COMPARE MARKER 5}
{ACTIVATE MARKER [ ]}
{Return}
{More 1/2}
{COMPARE MARKER 6}
{COMPARE MARKER 7}
{COMPARE MARKER 8}
{COMPARE MARKER 9}
{COMPARE MARKER 10}
{ACTIVATE MARKER[ ]}
{Return}
{More 2/2}
{MARKER 1}
{MARKER 2}
{MARKER 3}
{MARKER 4}
{MARKER 5}
{ACTIVATE MKR OFF}
{Return}
{More 1/2}
{MARKER 6}
{MARKER 7}
{MARKER 8}
{MARKER 9}
{MARKER 10}
{ACTIVATE MKR OFF}
{Return}
{More 2/2}
{FIXED MKR STIMULUS}
{FIXED MKR VALUE}
{FIXED MKR AUX VALUE}
{FIXED MKR → ACTIVE MKR}
{Return}


(6)
{MKR CMP/UNCMP}
{MKR CPL/UNCPL}
{CONVERSION MKR MENU}
{SMITH MKR MENU [ ]}
{POLAR MKR MENU [ ]}
{Return}
{DEFAULT}
{LIN MKR}
{Re/Im MKR}
{Return}
{LIN MKR}
{LOG MKR}
{Re/Im MKR}
{R+jX MKR}
{G+jB MKR}
{Z0 VALUE}
{Return}
{LIN MKR}
{LOG MKR}
{Re/Im MKR}
{Z0 VALUE}
{Return}

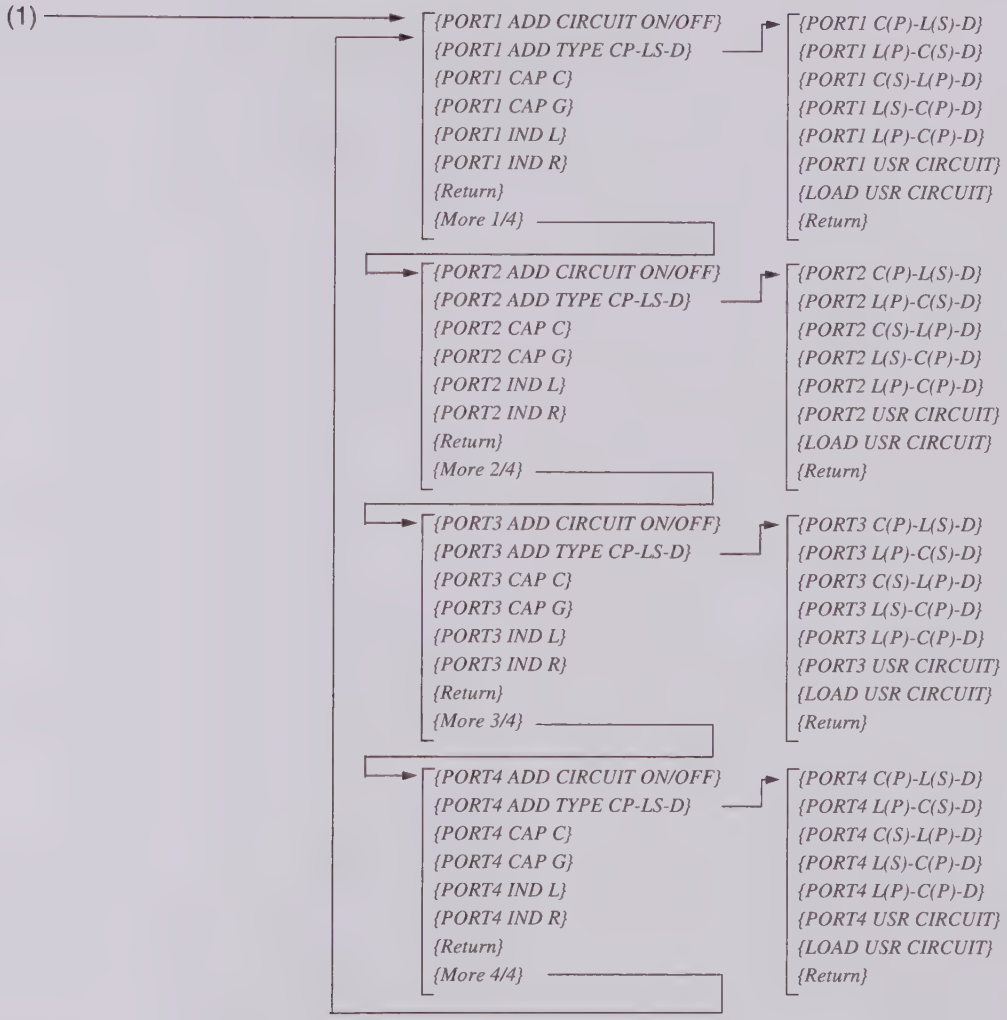

[MKR →]
{MARKER → START}
{MARKER → STOP}
{MARKER → CENTER}
{Δ MARKER → SPAN}
{MARKER → REF. VALUE}
{PART SRCH [ ]}
{MKR SEARCH [ ]}
{Δ MODE MANU}
{SET RANGE}
{STATISTICS ON/OFF}
{PART SRCH ON/OFF}
{Return}
{MKR SEARCH OFF}
{MAX}
{MIN}
{TARGET}
{RIPPLE}
{FLTR ANA [ ]}
{TRACKING ON/OFF}
{Return}
{TARGET VALUE}
{0°}
{±180°}
{LEFT SEARCH}
{RIGHT SEARCH}
{Return}
{MAX∩ }
{MIN∪ }
{Δ MAX∩ - MIN∪ }
{MAX - MIN}
{Δ X}
{Δ Y}
{Return}
{WIDTH VALUE}
{FILTER TYPE BAND/NOTC}
{SEARCH FROM [ ]}
{DISPLAY MODE ABS/REL}
{SEARCH IN/OUT}
{FLTR ANA ON/OFF}
{Return}
{ACTIVE MARKER}
{MAXIMUM VALUE}
{REFERENCE LINE}
{Return}



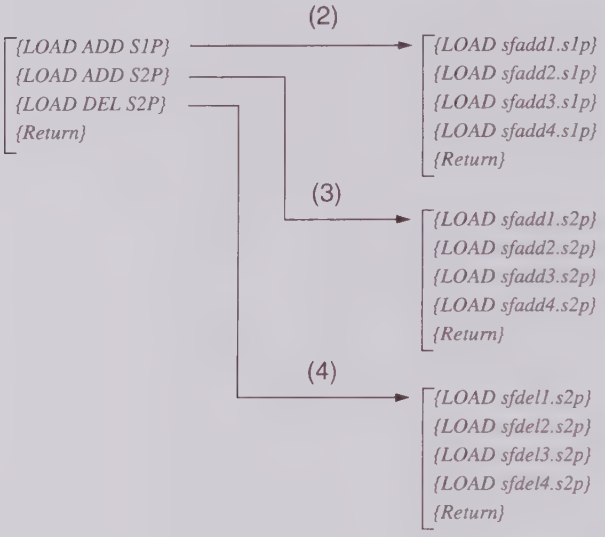
* 9: Refer to R17050 Automatic Calibration Kit Manual.
* 12: For OPT70 (Time Axis Analysis)

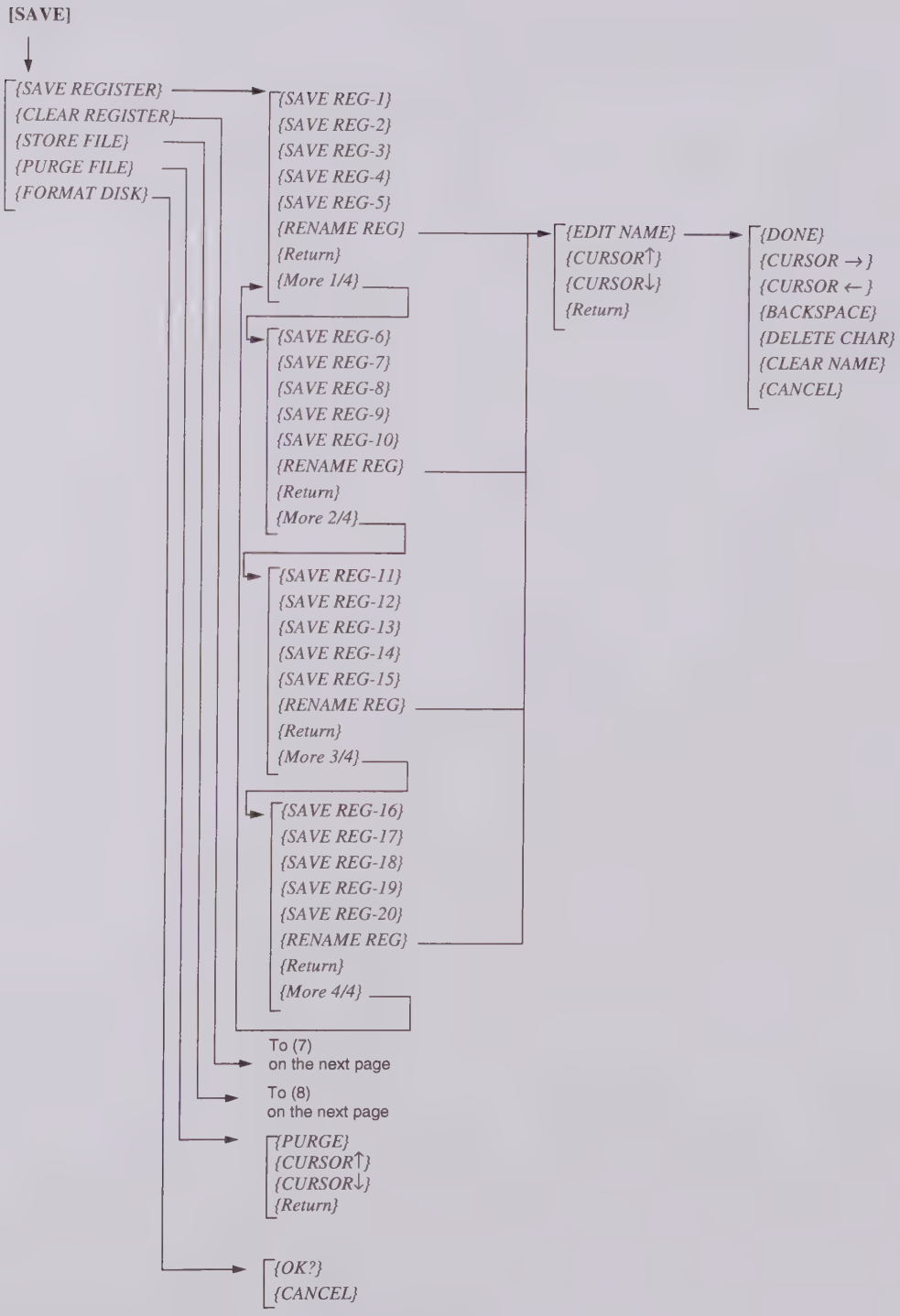

[FUNCTION] For OPT71 or 72 is installed
{SOFTWARE FIXTURE ON/OFF}
{PORT CONDITION}
{BALANCE MEASUREMENT}
{MODE ANALYSIS ON/OFF}
{FIXTURE LIST ON/OFF}
{LOAD USR CIRCUIT}
{SAVE FILE}
{Return}
{PORT EXTENSION OFF}
{DELETE CIRCUIT}
{NORMALIZE IMPEDANCE OFF}
{ADD CIRCUIT}
Next page (1)
{Return}
{MATCHING BALANCE P1}
{MATCHING BALANCE P2}
{BALANCE PARAMETER ON/OFF}
{FLOAT BALUN ON/OFF}
{DIFF BALUN ON/OFF}
{Return}
{LOAD ADD S1P}
Next page (2)
{LOAD ADD S2P}
Next page (3)
{LOAD DEL S2P}
Next page (4)
{Return}
{SAVE TS}
{SAVE CSV}
{SAVE DISP CSV}
{CSV FILE FORMAT DB/RI}
{Return}
{PORT EXTENSION ON/OFF}
{EXTENSION PORT1}
{EXTENSION PORT2}
{EXTENSION PORT3}
{EXTENSION PORT4}
{MARKER→EXTENSION}
{Return}
{PORT1 DEL CIRCUIT ON/OFF}
{PORT2 DEL CIRCUIT ON/OFF}
{PORT3 DEL CIRCUIT ON/OFF}
{PORT4 DEL CIRCUIT ON/OFF}
{LOAD DEL S2P}
{Return}
{IMPEDANCE TRANSFORM ON/OFF}
{PORT1 IMPEDANCE}
{PORT2 IMPEDANCE}
{PORT3 IMPEDANCE}
{PORT4 IMPEDANCE}
{Return}
{BALANCE P1 C(P)-L(P)-D ON/OFF}
{BALANCE P1 CAP C}
{BALANCE P1 CAP G}
{BALANCE P1 IND L}
{BALANCE P1 IND R}
{Return}
{BALANCE P2 C(P)-L(P)-D ON/OFF}
{BALANCE P2 CAP C}
{BALANCE P2 CAP G}
{BALANCE P2 IND L}
{BALANCE P2 IND R}
{Return}

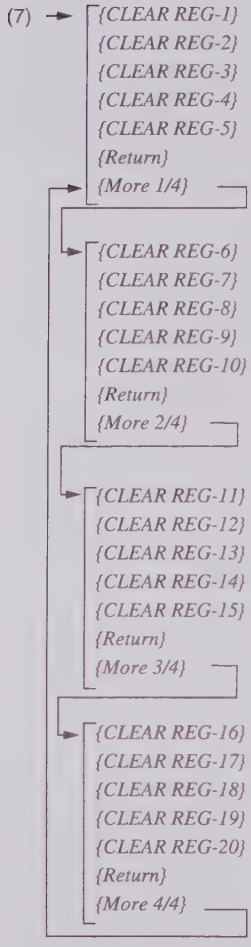
[FUNCTION] For OPT71 or 72 is installed (continued)

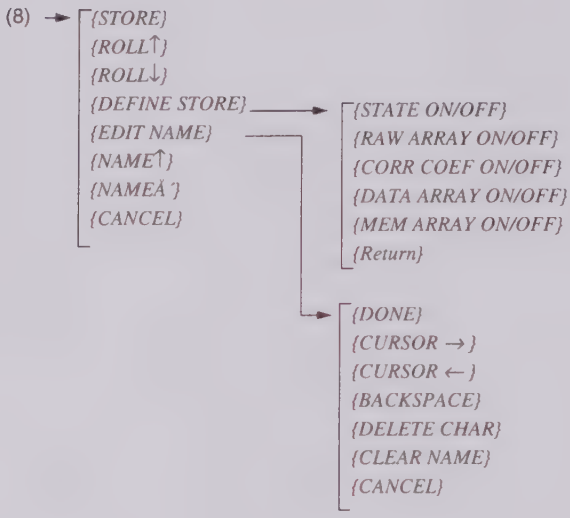


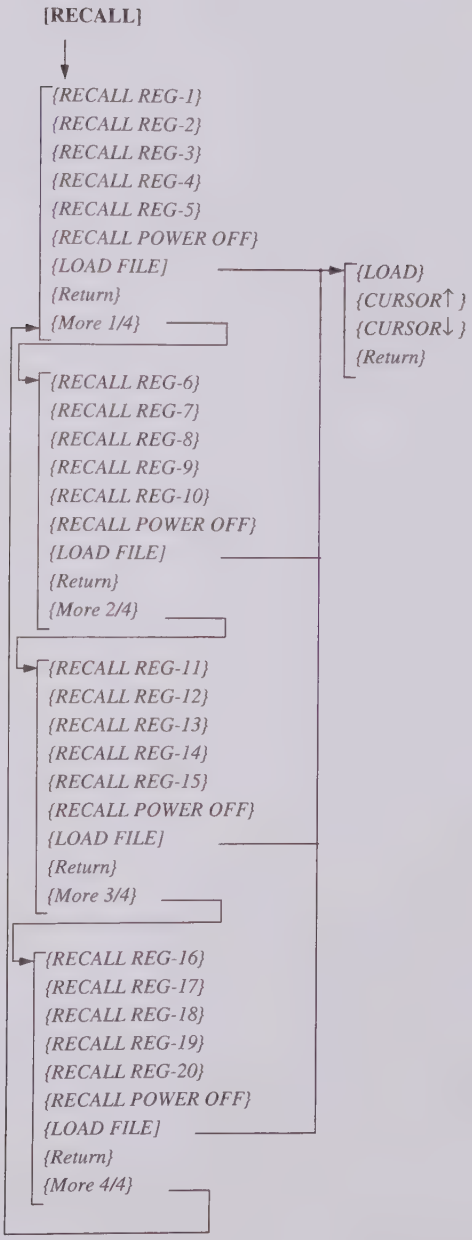
[FUNCTION] For OPT71 or 72 is installed (continued)

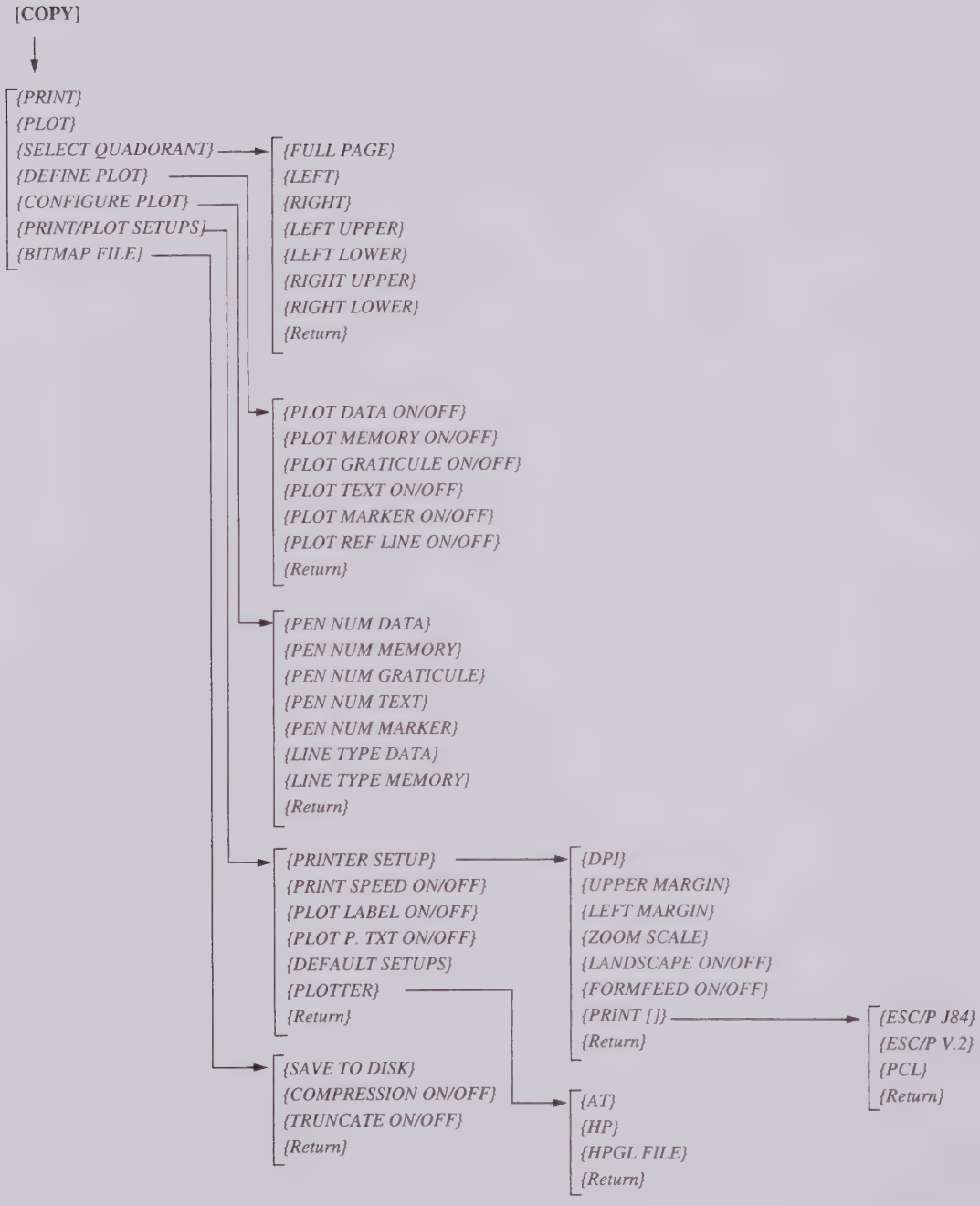


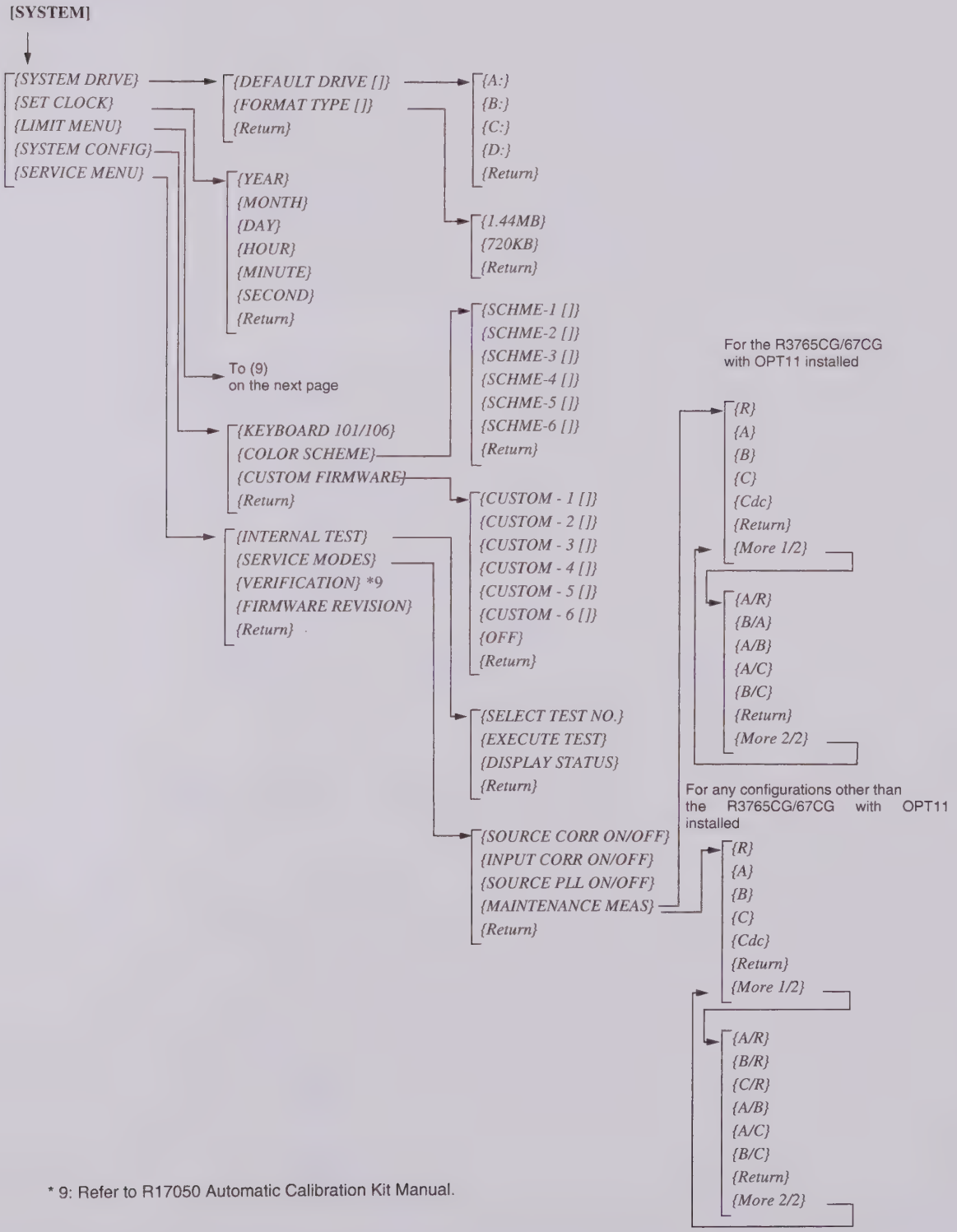

[SAVE]
{SAVE REGISTER}
{CLEAR REGISTER}
{STORE FILE}
{PURGE FILE}
{FORMAT DISK}
{SAVE REG-1}
{SAVE REG-2}
{SAVE REG-3}
{SAVE REG-4}
{SAVE REG-5}
{RENAME REG}
{Return}
{More 1/4}
{EDIT NAME}
{CURSOR↑}
{CURSOR↓}
{Return}
{DONE}
{CURSOR →}
{CURSOR ←}
{BACKSPACE}
{DELETE CHAR}
{CLEAR NAME}
{CANCEL}
{SAVE REG-6}
{SAVE REG-7}
{SAVE REG-8}
{SAVE REG-9}
{SAVE REG-10}
{RENAME REG}
{Return}
{More 2/4}
{SAVE REG-11}
{SAVE REG-12}
{SAVE REG-13}
{SAVE REG-14}
{SAVE REG-15}
{RENAME REG}
{Return}
{More 3/4}
{SAVE REG-16}
{SAVE REG-17}
{SAVE REG-18}
{SAVE REG-19}
{SAVE REG-20}
{RENAME REG}
{Return}
{More 4/4}
To (7)
on the next page
To (8)
on the next page
{PURGE}
{CURSOR↑}
{CURSOR↓}
{Return}
{OK?}
{CANCEL}


(7)
{CLEAR REG-1}
{CLEAR REG-2}
{CLEAR REG-3}
{CLEAR REG-4}
{CLEAR REG-5}
{Return}
{More 1/4}
{CLEAR REG-6}
{CLEAR REG-7}
{CLEAR REG-8}
{CLEAR REG-9}
{CLEAR REG-10}
{Return}
{More 2/4}
{CLEAR REG-11}
{CLEAR REG-12}
{CLEAR REG-13}
{CLEAR REG-14}
{CLEAR REG-15}
{Return}
{More 3/4}
{CLEAR REG-16}
{CLEAR REG-17}
{CLEAR REG-18}
{CLEAR REG-19}
{CLEAR REG-20}
{Return}
{More 4/4}


(8)
{STORE}
{ROLL↑}
{ROLL↓}
{DEFINE STORE}
{EDIT NAME}
{NAME↑}
{NAME↓}
{CANCEL}
{STATE ON/OFF}
{RAW ARRAY ON/OFF}
{CORR COEF ON/OFF}
{DATA ARRAY ON/OFF}
{MEM ARRAY ON/OFF}
{Return}
{DONE}
{CURSOR →}
{CURSOR ←}
{BACKSPACE}
{DELETE CHAR}
{CLEAR NAME}
{CANCEL}

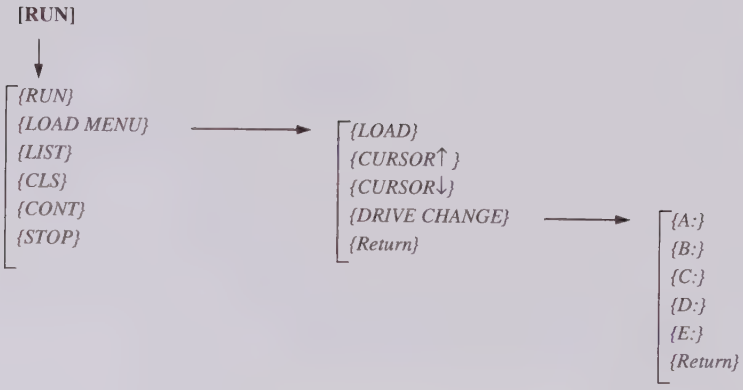

[RECALL]
{RECALL REG-1}
{RECALL REG-2}
{RECALL REG-3}
{RECALL REG-4}
{RECALL REG-5}
{RECALL POWER OFF}
{LOAD FILE}
{Return}
{More 1/4}
{LOAD}
{CURSOR↑ }
{CURSOR↓ }
{Return}
{RECALL REG-6}
{RECALL REG-7}
{RECALL REG-8}
{RECALL REG-9}
{RECALL REG-10}
{RECALL POWER OFF}
{LOAD FILE}
{Return}
{More 2/4}
{RECALL REG-11}
{RECALL REG-12}
{RECALL REG-13}
{RECALL REG-14}
{RECALL REG-15}
{RECALL POWER OFF}
{LOAD FILE}
{Return}
{More 3/4}
{RECALL REG-16}
{RECALL REG-17}
{RECALL REG-18}
{RECALL REG-19}
{RECALL REG-20}
{RECALL POWER OFF}
{LOAD FILE}
{Return}
{More 4/4}

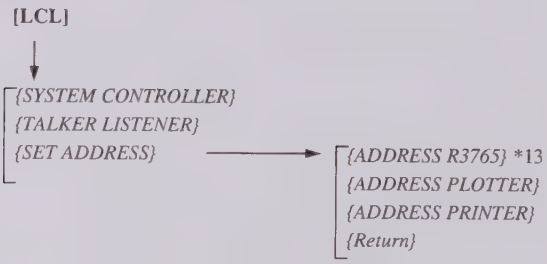

[COPY]
{PRINT}
{PLOT}
{SELECT QUADORANT}
{DEFINE PLOT}
{CONFIGURE PLOT}
{PRINT/PLOT SETUPS}
{BITMAP FILE}
{FULL PAGE}
{LEFT}
{RIGHT}
{LEFT UPPER}
{LEFT LOWER}
{RIGHT UPPER}
{RIGHT LOWER}
{Return}
{PLOT DATA ON/OFF}
{PLOT MEMORY ON/OFF}
{PLOT GRATICULE ON/OFF}
{PLOT TEXT ON/OFF}
{PLOT MARKER ON/OFF}
{PLOT REF LINE ON/OFF}
{Return}
{PEN NUM DATA}
{PEN NUM MEMORY}
{PEN NUM GRATICULE}
{PEN NUM TEXT}
{PEN NUM MARKER}
{LINE TYPE DATA}
{LINE TYPE MEMORY}
{Return}
{PRINTER SETUP}
{PRINT SPEED ON/OFF}
{PLOT LABEL ON/OFF}
{PLOT P. TXT ON/OFF}
{DEFAULT SETUPS}
{PLOTTER}
{Return}
{DPI}
{UPPER MARGIN}
{LEFT MARGIN}
{ZOOM SCALE}
{LANDSCAPE ON/OFF}
{FORMFEED ON/OFF}
{PRINT [ ]}
{Return}
{ESC/P J84}
{ESC/P V.2}
{PCL}
{Return}
{SAVE TO DISK}
{COMPRESSION ON/OFF}
{TRUNCATE ON/OFF}
{Return}
{AT}
{HP}
{HPGL FILE}
{Return}



* 9: Refer to R17050 Automatic Calibration Kit Manual.

(9)
{LIMIT LINE ON/OFF}
{LIMIT TEST ON/OFF}
{BEEP}
{LIMIT MODE MENU}
{EDIT LIMIT LINE}
{SELECT DATA 1ST/2ND}
{LIMIT LINE OFFSETS}
{Return}
{OFF}
{FAIL}
{PASS}
{BEEP TONE}
{Return}
{1ST DATA ON/OFF}
{2ND DATA ON/OFF}
{MAG DATA LIN/LOG}
{Return}
{SEGMENT}
{SELECT DATA 1ST/2ND}
{EDIT SEGMENT}
{DELETE}
{ADD SEGMENT}
{LIMIT TYPE}
{DONE}
{More 1/2}
{STIMULUS VALUE}
{MARKER TO STIMULUS}
{UPPER LIMIT}
{LOWER LIMIT}
{DELTA LIMIT}
{MIDDLE VALUE}
{MARKER TO MIDDLE}
{Return}
{LIMIT LINE ON/OFF}
{LIMIT TEST ON/OFF}
{BEEP}
{MAG DATA LIN/LOG}
{LIMIT MODE MENU}
{LIMIT LINE OFFSETS}
{CLEAR LIST}
{More 2/2}
{SLOPING LINE}
{FLAT LINE}
{SINGLE POINT}
{LIMIT COLOR}
{WAVE COLOR}
{Return}
{OFF}
{FAIL}
{PASS}
{BEEP TONE}
{Return}
{1ST DATA ON/OFF}
{2ND DATA ON/OFF}
{MAG DATA LIN/LOG}
{Return}
{STIMULUS OFFSET}
{AMPLITUDE OFFSET}
{MARKER TO AMP. OFS}
{Return}
{STIMULUS OFFSET}
{AMPLITUDE OFFSET}
{MARKER TO AMP. OFS}
{Return}
{YES}
{NO}





*13: For the R3767 Series, R3767 is displayed.

A.5 Other Information

A.5.1 Error Message

It's described in chapter "8 IN ABNOMALITIES" of this manual.

- Hardware Trouble . . . . . Refer to sub-section 8.2.1.
- Notice of Hardware Information . . . . . Refer to sub-section 8.2.2.
- Operating Error . . . . . Refer to sub-section 8.2.3.
- Warning of internal set, change, etc. . . . . Refer to sub-section 8.2.4.
- Notice of the Completion and the State of Operation. . Refer to sub-section 8.2.5.

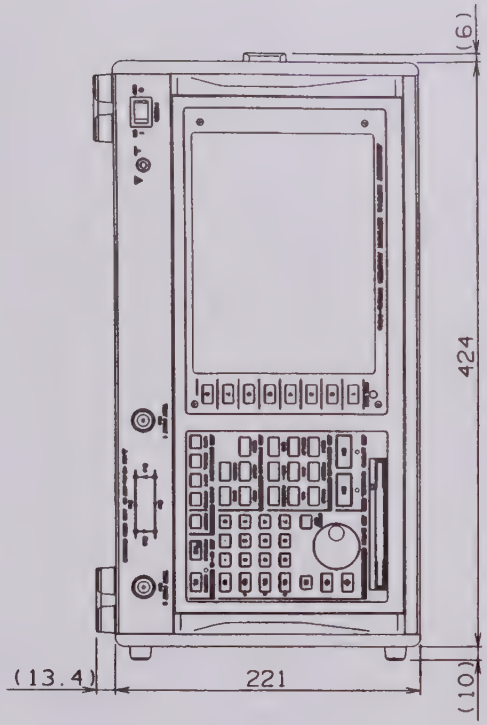
A.5.2 Setting of Backup Memory (at the factory-shipped)

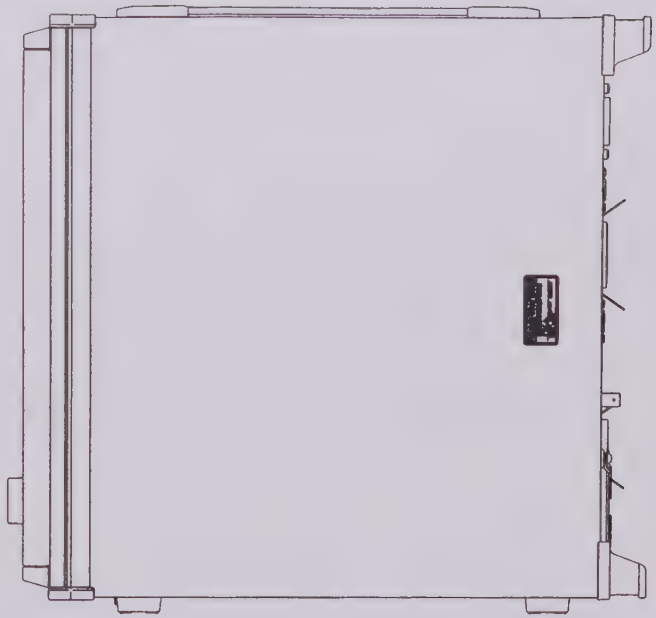
Item	Initial value
GPIB address	11
System controller/Addressable	Addressable
Printer GPIB address	18
Plotter GPIB address	5
Save register	All clear

A.5.3 GPIB Command List for Panel Key/Soft Key

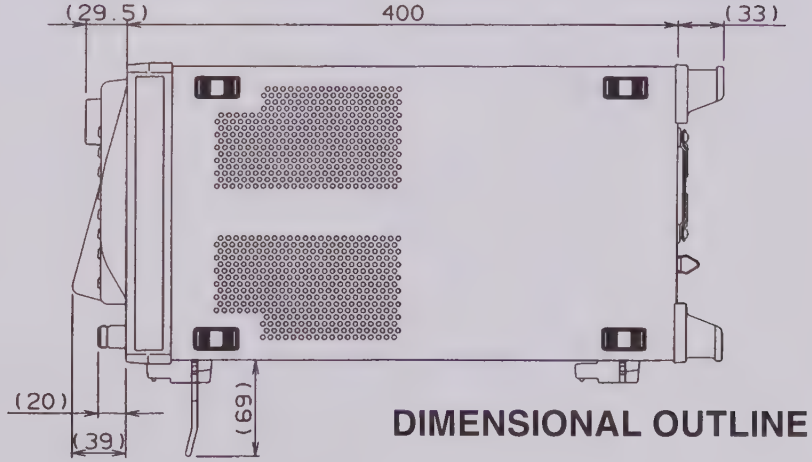
It's described in a separate-volume "Programming manual" part 2/Appendix A2.

- A2. GPIB command list for panel key/soft key
- A2.1 ACTIVE CHANNEL block
- A2.2 STIMULUS block
- A2.3 RESPONSE block
- A2.4 INSTRUMENT STATE block
- A2.5 GPIB block





AIR FLOW



Unit : mm

CAUTION
This drawing shows external dimensions of this instrument.
The difference in products and options used can cause a change in the appearance of the instrument.

DIMENSIONAL OUTLINE DRAWING

ALPHABETICAL INDEX

[Symbol]

ΔMKR mode 7-69
ΔREF=ACT MKR 7-70
ΔREF=ΔMKR 7-70
ΔREF=FIXED MKR 7-70
↑ 7-4
↓ 7-4
[-] 7-3
[.] 7-3
[0 to 9] 7-3
[AVG] 7-9
[BS] 7-3
[CAL] 7-9
[CENTER] 7-5
[CH 1] 7-2
[CH 2] 7-2
[COPY] 7-127
[DISPLAY] 7-9
[ENTRY OFF] 7-3
[FORMAT] 7-9
[FUNCTION] 7-9
[MEAS] 7-9
[MENU] 7-5
[MKR] 7-9
[MKR →] 7-9
[PRESET] 7-127
[RECALL] 7-127
[SAVE] 7-127
[SCALE] 7-9
[SPAN] 7-5
[START] 7-5
[STOP] 7-5
[SYSTEM] 7-127

[Numerics]

1-Port Full Calibration 7-32
1-port full calibration 7-38
2-Port Full Calibration 7-34
2-port full calibration 7-39

[A]

A measurement sample of 3dB bandwidth 3-13
A measurement sample of 6dB bandwidth 3-14
ACT MKR mode 7-69
ACTIVE CHANNEL Block 7-1
Active marker menu 7-65
Address menu 7-140
Annotation on the Screen (Annotation Character) 3-7
Attenuation Accuracy 10-67
Average menu 7-28
Averaging 7-30
Averaging process 7-30
Averaging/Smoothing and Resolution Bandwidth 7-28
AVG A-15

[B]

Balanced Matching Circuit Function . 7-104
Basic Key Operation Examples 4-1
Basic Measuring Procedure 3-8
BASICS OPERATION 4-1
BEEP 7-132
Bitmap File Setup 7-158

[C]

CAL A-15, A-17
Cal kit menu 7-43
Calibration 1-14, 7-31
Calibration (1- port full calibration) 3-22
Calibration (Normalize) 3-11
Calibration (two port full calibration) . 5-11
Calibration Data Clear 7-50
Calibration Kit Selection 7-43
Calibration Method 7-36
CDMA IF Filter Analysis Function 7-89
Character editing menu 7-145
Character menu 7-146
Cleaning 1-11
Clear limit menu 7-136
Clear register menu 7-147
Clearing Saved Register 7-147
Color menu 7-26
Colors Settings 7-26
Communication with Peripheral Devices 7-159
Completed Operation Conditions Messages 8-12
Connecting the Power Cable 1-8
Controller Menu 7-139
Conversion marker menu 7-72
Conversion Mode 7-84
COPY A-28
Copy menu 7-151
Crosstalk 10-24

[D]

Data Flow 9-2

Default drive menu 7-128
Degree of Balance Measurement Function 7-104
Delta mode menu 7-70
Delta-Marker Function 7-69
Device spec menu 7-111
DIP switches 7-155
Directivity 10-11
Disk format menu 7-129
DISPLAY A-14
Display Data Format 7-14
Display Layout 7-18
Display menu 7-16
Displaying Marker Read out Value .. 7-68
Drive menu 7-139
Dynamic Level Accuracy 10-47

[E]

Edit limit menu 7-134
Edit segment menu 7-136
Editing Segment of Program Sweep 7-95
Editing Segment of User Frequency Sweep 7-94
ENTRY Block 7-3
ENTRY OFF key 7-4
Entry off key 3-6
Error Messages 8-2
Executing Recall 7-148
Executing Save Register 7-142
Executing Store File 7-144
Extending Measurement Reference Plane 7-47

[F]

FEMAL/MAL selection menu 7-44
File data menu 7-144
File List Display 7-142
Filter analysis menu 7-77
FIXED MKR mode 7-69
FORMAT A-13
FORMAT ARRAY 6-9
Format menu 7-14
Four Screen Display 5-19
Four Screen Display and Display Selection Information 7-16
Frequency Accuracy and Range 10-4
Front-Panel Descriptions (R3765AG/67AG) 2-1, 2-2
Front-Panel Descriptions (R3765BG/67BG) 2-3, 2-4
Front-Panel Descriptions (R3765CG/67CG (OPT 14)) 2-9
Front-Panel Descriptions (R3765CG/67CG (Option 11)) 2-7, 2-8, 2-10
Front-Panel Descriptions (R3765CG/67CG) 2-5, 2-6
FUNCTION A-21, A-22, A-23, A-24

[G]

Gate Function 7-87
Gate function 7-89
GETTING STARTED 1-1
GO/NG Measurement Using Limit Line Function 5-45
GPIB Block 7-138
GPIB Menu 7-140
Group delay measurement 3-17

[H]

Hard Copy 7-151
Hardware Trouble 8-2
High-speed Measurement Using the Program Sweep Function . 5-40
How to Initialize 4-3
How to Read the Display Screen 3-7

[I]

Impedance Conversion Function 7-99
Impedance Measurement 3-29
IN ABNORMALITIES 8-1
Initial Power-on 3-1
Initial Setting A-4
Initial Setup 4-3
Initial Setup Value 4-3
Input Signal Level Overload Cautions 1-9
Inspection and Simple Troubleshooting 8-1
INSTRUMENT STATE Block 7-127
Instruments Required 10-67
Interlocking between Channels 7-8
Interpolating Calibration Data 7-42
Interpolation between Measurement 7-68

[L]

Label Input 7-25
Label menu 7-25
Label Window Display 7-25, 7-145
LCL A-31
Limit Function 7-132
Limit Menu 7-132

Limit mode menu 7-133
Limit type menu 7-137
Linear Magnitude/
Phase Measurement 5-9
Linear magnitude/
phase measurement 5-5
Load file menu 7-150
Load Match 10-14
Load menu 7-139
Logarithmic Magnitude/
Group Delay Measurement 5-8
Logarithmic magnitude/
group delay measurement 5-4
Logarithmic Magnitude/
Phase Measurement 5-7

[M]

Magnitude analysis function 7-89
Magnitude measurement 3-12
Magnitude/Phase Measurement 5-2, 5-3
Marker Analysis Function 7-73
Marker Coupling between Channels 7-66
Marker Function 7-64
Marker Menu during Impedance
Measurement 7-72
Marker mode menu 7-72
Marker search menu 7-74
Matching Circuit Function 7-102
Matching circuit menu 7-112
MEA A-10, A-11, A-12
Measurement Jig 7-119
Measurement menu 7-10
MEASUREMENT METHOD
EXAMPLE 5-1
Measurement of Electrical Length ... 5-36
Measurement of Transmission
Characteristic (2 Trace Display) 5-1
Measurement Samples of
Simple Reflection Characteristics 3-20
Measurement Samples of
Simple Transmission Characteristics 3-9
Measurement Time 1-9
Measuring Time A-3
MEM ARRAY 6-9
MENU A-9
MKR A-19
MKR → A-20
Mode Analysis Function 7-106
Multi-marker List Display 5-28

[N]

Name editing menu 7-145
Narrow Band/Wide Band Sweep
Measurement 5-25
Network Elimination Function 7-99
Noise Level 10-21
Normalize & Isolation Calibration 7-32
Normalize & isolation calibration 7-37
Normalizing 7-31
Normalizing (reflection) 7-36
Normalizing (transfer) 7-36
Note on the Probe Connector 1-9
Notes on the use of Parallel I/O Ports 1-9
Notes on the use of Serial I/O ports . 1-9
Notes on Use 1-12
Notice of Hardware Information 8-3
Numeric keys 7-3

[O]

Offset Entry menu 7-46
Offset limit menu 7-137
OPEN Standard Entry Menu 7-46
Operating Environment 1-5
Operating Error 8-4
Operation Procedure 7-110
OPT10 10-67
OPT70 7-84
Output Level Accuracy and Flatness 10-5
Output Level Linearity 10-8
Output of Measured Data
to the Plotter 6-1
Overlap Display Mode (Two Traces
per Screen Measurement) 5-1

[P]

PANEL DESCRIPTION 2-1
Panel Keys 3-3
Parallel I/O Port 7-159
Parameter conversion menu 7-13
Parameters Entry of an User-selected
Calibration Kit 7-44
Part search menu 7-83
PERFORMANCE TEST 10-1
Phase analysis function 7-89
Phase measurement 3-15
Plot data menu 7-153
Plot scale menu 7-152
Plotter pen menu 7-153
Plotter Setup 7-154
Polar marker menu 7-73
Port extension menu 7-48, 7-111

Port spec menu 7-111
Power menu 7-6
Power Supply Specifications 1-7
Preparing for a Performance Test 10-1
Printer menu 7-157
Printer Setup 7-156
Product and Attachment 1-2
Product Description 1-1
Program sweep segment editing menu 7-95
Purges files menu 7-148
Purging Stored File 7-148

[R]

RAW ARRAY 6-9
Real-time clock menu 7-129
Rear Panel Descriptions 2-11
Rear Panel Descriptions (R3765CG/67CG) 2-12
RECALL A-27
Recall menu 7-148
RECORD and OUTPUT 6-1
Reflection Coefficient Measurement 3-26
Register List Display 7-145
Replace the Protective Fuse for Bias Input 1-10
Replacing Parts with Limited Life 1-14
Replacing the Power Fuse 1-7
Required Measurement Instrument for Performance Test 10-1
RESPONSE Block 7-9
Return Loss Measurement 3-25
Ripple Measurement in the Bandwidth 5-31
Ripple menu 7-75
RS-232 Interface 7-168
RUN A-31

[S]

S Parameter Measurement 3-28
SAVE A-25
Save File menu 7-112
Save menu 7-141
Save register 7-141
Save register menu 7-142
Save/Recall 7-141
Saving Menu 7-46
Saving Results 7-109
Saving to the Floppy Disk 6-7
SCALE A-13
Scale menu 7-15
Screen Display Descriptions 2-13
Search menu 7-74
Selecting Plot Data 7-153
Selection of Save Type 7-141
Setting Backup Memory 4-7
Setting Display Coordinate Scale 7-15
Setting File Name 7-146
Setting Input and Parameter Conversion 7-10
Setting Marker 7-65
Setting Plot Scale 7-152
Setting Register Name 7-145
Setting Signal Source 7-6
Setting Sweep Type 7-93
Setup menu 7-154, 7-156
Signal source menu 7-6
Smith marker menu 7-72
Smoothing 7-30
Smoothing process 7-30
Soft Key Menu Configuration 4-2
Soft Key Menu List A-9
Soft Keys 3-3
Software Balun Function 7-105
Software Fixture Function 7-98
Software fixture menu 7-110
SPECIFICATIONS 11-1
Specifications 10-67
Specifying Pen 7-153
Split Display 5-6
Standard attachment 1-2
Standing Wave Ratio (SWR) Measurement 3-27
statistical analysis function 7-83
Status Display 7-42
Step key 7-4
STIMULUS Block 7-5
Storage 1-11
Store file 7-141
Store file menu 7-144
Supply Description 1-7
Sweep 7-93
Sweep type menu 7-93
SYSTEM A-29
System drive menu 7-128
System Menu 7-128
System Setup Cautions 1-9

[T]

Target menu 7-75
Testing Procedure 10-67
THE BASICS 3-1
The Relation of Data between each Function A-1

Time Domain Function 7-84
Time Domain Function (Option 70) .. 7-84
Trace Data Selection 7-23
Trace data selection menu 7-23
TRACE Operation 7-24
Trace operation menu 7-24
Transmission Reflection Characteristic Measurement (Four Screen Display Mode) 5-10
Transportation 1-11
Trigger menu 7-7
Two Channels Simultaneous Display 5-26

[U]

Unit key 7-4
User frequency sweep segment editing menu 7-94
User specifying menu 7-45
Using the Save/Recall Register 6-5

[W]

Warning of Internal Set, Change, etc. 8-9
Window processing 7-86

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